

NOTES ON THE FLORA OF TAIWAN (9)

The *Viola* L. (Violaceae)⁽¹⁾

JENN-CHE WANG⁽²⁾ and TSENG-CHIENG HUANG⁽³⁾

(Manuscript received 8 December, 1989; revised version accepted 2 April, 1990)

Abstract: A taxonomic treatment of the genus *Viola* L. (Violaceae) in Taiwan is provided in the present study. There are 18 taxa and one doubtful species, including four new combinations. Based on the morphological characteristics, the *Viola* of Taiwan is divided into eight groups with one to four taxa within each group.

INTRODUCTION

Viola, the largest genus of the family Violaceae, is delimited by the following diagnostic features: perennial herbs; leaves simple, alternate, with persistent stipules; flower axile, solitary, zygomorphic, 5-merous, the lower petal spurred at base; stamens connivent around the gynoecium, the connective produced into an apical appendage; gynoecium 3-carpelate, one locule; fruit a 3-valved capsule (Heywood, 1978).

The classification of this genus is confused, although Becker (1925) revised it in "Die Natürlichen Pflanzenfamilien" edited by Engler and Prantle. He divided the genus into 14 sections, and subdivided the largest section *Normimum* into 17 subgroups. His classification was mainly based on the characteristics of flower colour, stipule, and especially the shapes of style and stigma. His system is sometimes hard to use because he overemphasized the distinction of styles and splited the genus into many small groups (Hashimoto, 1967a). Jacob and Moore (1971) suggested that "any useful subsectional treatment must wait a monographic revision of the whole genus". The authors agree with them and use "group" instead of the taxonomic rank (i.e. section, subsection) here. The group names used by us and the contents of each group are listed in Table 1.

The total number of *Viola* in Taiwan was reported as 13 (Hsieh, 1977), 17 (Hashimoto, 1959), 18 (Nakai, 1922), 21 (Lin, 1950), 22 (Sasaki, 1928), 24 (Masamune, 1936) and 25 (Masamune, 1954) by different taxonomists. The great disagreement showed above is probably due to high variation, common hybridization (Valentine, 1962; Lin, 1950) and the accompanying introgression.

This paper describes a classification based on an intensive study of all characteristics, including morphology, palynology cytology, phytochemistry and ecology (Wang, 1988, unpubl.). Eighteen taxa and one doubtful species belonging to eight groups are recognized in this taxonomic study.

(1) This is a part of Ph.D. dissertation "A Taxonomic Study of *Viola* (Violaceae) of Taiwan" presented by the first author under the guidance of the second author. This work is partly supported by a grant of NSC77-0201-B002-07 to T.C. Huang.

(2) 王震哲, Associate Professor, Department of Biology, National Taiwan Normal University, Taipei, Taiwan, R. O. C.

(3) 黃增泉, Professor, Department of Botany, National Taiwan University, Taipei, Taiwan, R. O. C.

Table 1. The subgroup names and the contents of each subgroup of Taiwanese *Viola*

Group names	Taxa
<i>Dischidium</i>	<i>V. biflora</i> L. 雙黃花堇菜
<i>Trigonocarpae</i>	<i>V. grypoceras</i> A. Gray 紫花堇菜 <i>V. obtusa</i> (Makino) Makino var. <i>tsuifengensis</i> Hashimoto 翠峰堇菜 <i>V. shinchikuensis</i> Yamamoto 新竹堇菜
<i>Bilobatae</i>	<i>V. arcuata</i> Blume 如意草
<i>Adnatae</i>	<i>V. betonicifolia</i> J. E. Sm. 箭葉堇菜 <i>V. confusa</i> Champ. ex Benth. 短毛堇菜 <i>V. inconspicua</i> Blume ssp. <i>nagasakiensis</i> (W. Becker) J. C. Wang & T. C. Huang 小堇菜 <i>V. mandshurica</i> W. Becker 紫花地丁
<i>Plagiostigma</i>	<i>V. senzanensis</i> Hayata 尖山堇菜
<i>Diffusae</i>	<i>V. diffusa</i> Ging 茶匙黃 <i>V. nagasawai</i> Makino & Hayata 臺北堇菜 <i>V. nagasawai</i> var. <i>pricei</i> (W. Becker) J. C. Wang & T. C. Huang 普菜 氏堇菜 <i>V. tenuis</i> Benth. 心葉茶匙黃
<i>Serpentes</i>	<i>V. adenothrix</i> Hayata 喜岩堇菜 <i>V. adenothrix</i> var. <i>tsugitakaensis</i> (Masamune) J. C. Wang & T. C. Huang 雪山堇菜
<i>Formosanae</i>	<i>V. formosana</i> Hayata 臺灣堇菜 <i>V. formosana</i> var. <i>stenopetala</i> (Hayata) J. C. Wang, T. C. Huang & T. Hashimoto 川上氏堇菜

The specimens examined in this study are over 3,000 sheets, including 32 type specimens. All specimens are marked with the acronyms of herbaria as follows except those of TAI herbarium.

L: Rijksherbarium, Leiden

NTUF: Herbarium of Department of Forestry, National Taiwan University

TAI: Herbarium of Department of Botany, National Taiwan University

TAIF: Herbarium of Taiwan Forestry Research Institute

TI: Herbarium of Tokyo University, Japan

TAXONOMIC TREATMENT

Viola L., Sp. Pl., 933, 1753; Gen. Pl. ed. 5, 402, 1754; W. Becker in Beih. Bot. Centralbl. Abt. 2, 34: 208, 1916; *ibid.* 373, 1917; in Bot. Jahrb. 54, Beibl. 120: 156, 1917; in Beih. Bot. Centralbl. Abt. 2, 36: 15, 1918; *ibid.* 40: 20, 69, 119, 1923; in Engl. & Prant. Pfl. Fam. ed. 2, 21: 363, 1925; Nakai in Bot. Mag. Tokyo 30: 276, 1916; *ibid.* 36: 52, 84, 118, 1922; in Bull. Soc. Bot. France 72: 180, 1925; Lin in Taiwania 1: 269, 1950; Maekawa in Hara, Enum. Pl. Jap. 194, 1954; Hashimoto in Bull. Jap. Assoc. Bot. Gard. 29, 1959; M. Jacob & D. M. Moore in van Steenis, Fl. Malesiana 7: 198, 1971; Hsieh in Li *et al.*, Fl. Taiwan 3: 769, 1977.

Perennial herb. Leaves alternate, petiolate; blade suborbicular to linear-lanceolate, the margin serrate to crenate. Stipules free or adnate to petiole, persistent, usually fimbriate or serrate, sometimes nearly entire. Flowers axillary,

bisexual, zygomorphic, solitary, with a pair of bracteoles in the half of the peduncles; sepals 5, nearly equal, entire to denticulate, with appendages at base, persistent; petals 5, unequal, the lower one spurred at base, the lateral pair often bearded inside. Stamens 5, connivent around the gynoecium; anther 2-celled, subsessile, connective produced into an apical appendage, the lower two bearing appendages projecting into the spur. Ovary 1-celled, glabrous or pubescent, ovules numerous, on 3-parietal placentae; style straight or geniculate at base, filiform to conspicuously clavate, often lobed or more or less dilated at apex, with a opening of stigmatic cavity terminal or anterior and subterminal. Fruit a 3-valved capsule, globose to ellipsoidal; valves boat-shaped, usually with thick rigid keels. Seeds numerous, ovoid or ellipsoidal with crustaceous testa.

More than 400 species, chiefly in temperate regions throughout the world. 18 taxa and one doubtful species in Taiwan.

Key to the species

1. Flower yellow; leaves reniform to broadly ovate, apex rounded or obtuse (*Dischidium* group).....4. *V. biflora*
1. Flower purple or white
 2. Plants without stems or stolons; stipule adnate to petiole more than 1/2 of length
 3. Stipule adnate to petiole less than 2/3 of length; basal petal rounded at apex; rhizome long creeping, nodose; leaves triangular-ovate (*Plagiostigma* group)13. *V. senzanensis*
 3. Stipule adnate to petiole up to 3/4 of length; basal petal truncate or emarginate at apex; rhizome short, stout (*Adnatae* group)
 4. Roots dark brown10. *V. mandshurica*
 4. Roots white or yellowish brown
 5. Spur slender, 2.5–6 mm long, lateral petals usually beardless....5. *V. confusa*
 5. Spur short, up to 3.5 mm long, lateral petals bearded
 6. Upper petals usually bearded3. *V. betonicifolia*
 6. Upper petals beardless.....9. *V. inconspicua* ssp. *nagasakiensis*
 2. Plants with stems or stolons
 7. Petioles winged; basal petal shortest, acute or acicular at apex (*Diffusae* group)
 8. Flower less than 1.5 cm in diameter; plants with stems and stolons
 9. Leaves cuneate or shallowly cordate at base; lateral petals usually bearded6. *V. diffusa*
 9. Leaves cordate at base; lateral petals usually beardless15. *V. tenuis*
 8. Flower more than 1.5 cm in diameter; plants without stems
 10. Leaves ovate, lateral petals beardless11a. *V. nagasawai* var. *nagasawai*
 10. Leaves triangular-ovate, lateral petals bearded.....
 -11b. *V. nagasawai* var. *pricei*
 7. Petioles wingless
 11. Basal petal truncate or emarginate at apex
 12. Flowers small, less than 1.5 cm in diameter (*Bilobatae* group)....2. *V. arcuata*
 12. Flowers large, more than 2 cm in diameter
 13. Spur slender, more than 4 mm long; basal petal longest, emarginate at apex (*Formosanae* group)

- 14. Leaves orbicular or orbicular-cordate, rounded or obtuse at apex 7a. *V. formosana* var. *formosana*
- 14. Leaves cordate, acute at apex 7b. *V. formosana* var. *stenopetala*
- 13. Spur rounded, less than 2 mm long, basal petal shortest, truncate or emarginate at apex (*Serpentes* group)
- 15. Leaves membranous, usually hirsute; lateral petals usually bearded..... 1a. *V. adenothrix* var. *adenothrix*
- 15. Leaves chartaceous to subcoriaceous, usually glabrous; lateral petals usually beardless..... 1b. *V. adenothrix* var. *tsugitakaensis*
- 11. Basal petal rounded or obtuse at apex (*Trigonocarpace* group)
- 16. Lateral petals bearded; style papillose at apex; capsule globose..... 14. *V. shinchikuensis*
- 16. Lateral petals beardless; style smooth at apex; capsule ellipsoid
- 17. Leaf-blades cordate, usually as long as or shorter than wide..... 8. *V. grypoceras*
- 17. Leaf-blades triangular ovate, usually longer than wide 12. *V. obtusa* var. *tsuifengensis*

Description of taxa

1. *Viola adenothrix* Hayata, Icon. Pl. Form. 3: 23, fig. 9, 1913.

1a. *Viola adenothrix* var. *adenothrix*.

喜岩草 Fig. 1

Viola adenothrix Hayata, Icon. Pl. Form. 3: 23, fig. 9, 1913. Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 33. (Syntype, Hayata s. n. Jan. 25, 1912, TI!)

Viola brachycentra Hayata, Icon. Pl. Form. 3: 25, fig. 10, 1913.

Viola taiwanensis W. Becker in Fedde, Rep. 17: 315, 1921.

Viola thrichopoda Hayata, Icon. Pl. Form. 3: 29, fig. 15, 1913. (Syntype, Mori s. n. Jan. 1908, TI!)

Viola kusanensis (non Hayata) Nakai in Bot. Mag. Tokyo 36: 87, 1922; Lin in Taiwania 1: 276, 1950.

Viola rupicola (non Elm.) Merrill, Enum. Philip. Fl. Pl. 3: 106, 1923 (*pro parte*); Lin in Taiwania 1: 273, 1950; Jacob & Moore in van Steenis, Fl. Malesiana 7: 210, 1971 (*pro parte*); Hsieh in Li *et al.* Fl. Taiwan 3: 779, pl. 816, 1977.

Viola royleana (non Wallich) Nakai in Bot. Mag. Tokyo 36: 87, 1922.

Perennial herb; rhizome erect to ascending, rather stout, bearing leaves and flowers, and usually stem at apex, stem up to 25 cm high, creeping to ascending, sometimes rooting at nodes. Leaves 1-5 cm long, 1-4 cm broad, elliptical to elliptic-ovate or ovate-cordate, cordate at base with rounded basal lobes, acute at apex, shallowly crenate on margin, subdentate on lobes, wingless, usually hirsute, rarely slightly pubescent, membranous or herbaceous; petioles 1-15 cm long, slender, hirsute. Stipules 3-16 mm long, 2-6 mm broad, ovate to lanceolate, acuminate at apex, fimbriate or laciniate on margin, glabrous. Flowers 15-24 mm across, pale purple to almost white with darker veins; peduncles 2-12 cm long, slender, usually exceeding leaves, glabrous or pilose. Sepals 3-7 mm long, 1-1.5 mm broad, lanceolate, acute at apex, entire, sparsely pubescent; appendages ca. 0.5 mm long, rounded. Petals obovate to oblanceolate, basal usually shorter than the others, emarginate at apex, the laterals bearded, rarely beardless; spurs 0.8-2 mm long, exceeding calycine appendages, cylindrical, obtuse. Styles 1.4-1.6 mm long,

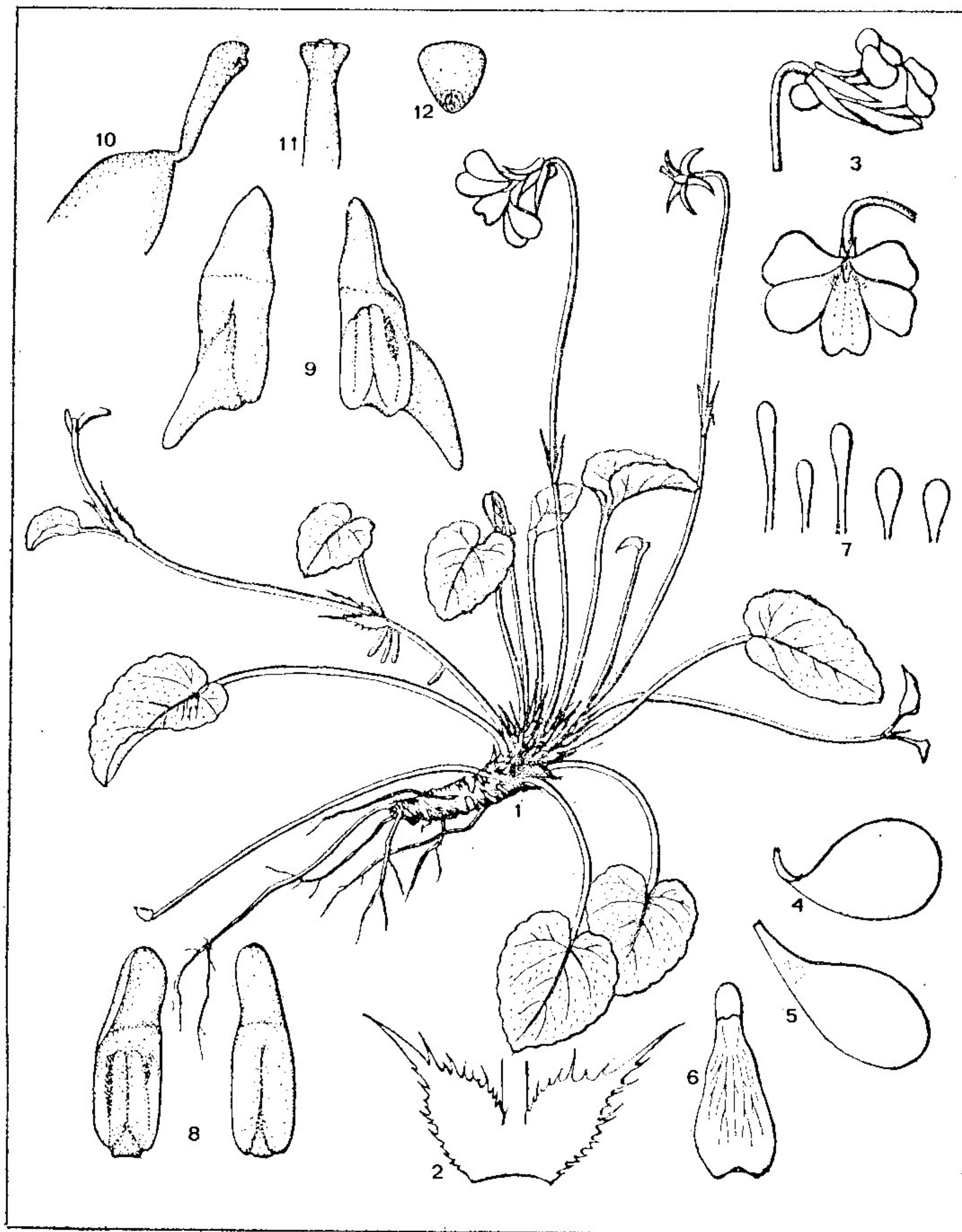


Fig. 1. 喜岩堇菜 *V. adenothrix* Hayata

1. Habit; 2. Stipule; 3. Flowers; 4. Upper petal; 5. Lateral petal;
6. Basal petal; 7. Beard; 8, 9. Stamens; 10. Pistil; 11, 12. Styles.

geniculate at base, clavate distally, apex distinctly lobed on both sides, with anterior stigmatic beak. Capsules 6–9 mm long, ellipsoid, glabrous. Seeds ovoid, 1–1.2 mm long. Chromosome number: $n=12$.

Distribution: Endemic.

Specimens examined:

Taipei: Lalashan-Fushan, *Yang* 1340; Lalashan-Korerogan, *T. Suzuki* 18173; Ruggyahu Kyoan, *T. Suzuki* 16488.

Taoyuan: Lalashan, *Kuo* 4793, *Wang* 947, *Yang* s.n. Jan. 26, 1986; Tsutuan-Ssuling, *Wang* 3521, 3525, 3526, 3527.

Hsinchu: Luchangtashan, *Fukuyama* 3410, *Simada* 2527b (NTUF); Mt. Rokudyo, *Simada* 2528, 2529; Mt. Tentana, *Simada* s.n. Apr. 6, 1918 (TAIF); Litungshan, *Matuda* s.n. Jul. 29, 1918 (TAIF), *Chen* s.n. Mar. 8, 1987; Kwanwu, *Wang* 4128; Madalashi-99 Hostel, *Wang* 4120, 4122; Kwaishan, *Wang* 4783.

Taichung: Chihyoushan-Taoshan, *Wang* 3886, 3887; E-W Cross Island Highway *Wang* 3481, 3482; Gukuan-Chingshan, *Murata* 17573; Chingshan, *Wang* 3484; Anmashan, *Huang* 8092; Hassenzan, *T. Suzuki* 5627, *S. Suzuki* s.n. Oct. 22, 1929, *Sasaki* s.n. Dec. 1928; Lishan, *Huang* 10385, *Wang* 2645, 3051, 3475, 3476, 3479, 3483, 4134, 4135, *T. Y. Yang* 1190; Pilushi, *Wang* 3093; Chungyang-chienshi, *Wang* 3580; Nanhushi, *Wang* 3584; Kwanmen, Central Mt. Range, *Mori* s.n. Apr. 15, 1910.

Nantou: Chitou, *T. Y. Yang* s.n. Jan. 28, 1986, *Ou & Kao* 8912, *C. C. Kuo* 2700; Chitou tract, *Chuang et al.* 3159; Shanlinshi, *Tang* 1779, *C. H. Chen* s.n. Mar. 26, 1986; Chiti, *Hsu* 9003; Tsueifeng, *S. M. Chao* 609, *S. F. Huang* s.n. Jan. 22, 1986, *Tang* s.n. Oct. 19, 1985, *Wang* 4196, *Jeng* 1856, *Hayata* s.n. Apr. 23, 1916 (TAIF); Tungpu-dueikuan, *Wang* 4285; Dueikuan, *Moritani* 2410, *Sasaki* s.n. Dec. 14, 1923 (TAIF); Dueikuan-Kwankao, *S. H. Chen* s.n. Jul. 6, 1985, *Wang* 4286, *Yang* s.n. Oct. 22, 1986; Hohuanshan, *Ying* 593 (NTUF), 636 (NTUF); Kunyang-Yuanfeng, *Wang* 3421, 3425, 3426, *T. Y. Yang* 3840; Hsinjenkang, *Wang* 3878, 3879, 3882; Hsinjenkang-Yuanfeng, *Lin* s.n. May 31, 1985; Meifeng, *Ou & Kao* 9317; Chungyang Gold Mine, *Wang* s.n. Apr. 20, 1987; Pingkuoshan, *Tang* s.n. May 13, 1987; Kidai-shiunanho, *Sasaki* s.n. Aug. 24, 1929; Kwankao, *Sasaki* s.n. Dec. 14, 1923; Tonbara-Onoue, *Fukuyama* 4401, 4403, 4671, 4673; Noko-Onoue, *Sasaki* s.n. Aug. 25, 1929; Noko-Musya, *Simada* s.n. Mar. 7, 1918 (TAIF); Onoue-Musya, *Sasaki* s.n. Aug. 26, 1929.

Chiayi: Arishan, Bandaizan, *Hayata* s.n. Jan. 25, 1912 (Type of *Viola adenothrix*, TI!); Alishan, *Kudo & Suzuki* 16233, *Sasaki* s.n. Oct. 9, 1927, s.n. Mar. 12, 1910, s.n. Dec. 1927, s.n. Jan. 1911 (TAIF), *Kuo* 3110, *H. J. Chang* 2389, *Hsu & Kuo* 6793, 6806, 6833, *Huang & Kao* 1610, *Y. F. Chen* 4140, 5211, *S. H. Chen* s.n. Jan. 26, 1986, s.n. Mar. 9, 1985, *T. Y. Yang* s.n. Jul. 16, 1986, *Chen* s.n. May. 9, 1987, *Yang* s.n. Jan. 14, 1986, *Hayata* s.n. Apr. 3, 1914 (TAIF); Erhwanping, *Sasaki* s.n. Mar. 20, 1921; Alishan-Shihhou (Monkey Rock), *T. Y. Yang* s.n. Jul. 16, 1986; Minyueh, Alishan, *Chen* s.n. Jan. 1988; Seizan, *Yamada* 43, *S. Suzuki* s.n. Jul. 10, 1933; Alishan-Tungpu, *Jeng* 2340; Tashan (Tozan), *Sasaki* s.n. May, 1913 (TAIF), *Nakamura* 4107, *Wang* 4207, 4207b, 4208, 4209, 4213, *H. Keng* 1099 (L), *Ishizaki* s.n. Jun. 3, 1924; Hsiaotashan, *Ishizaki* s.n. Jun. 3, 1924. Tzushan, *Wang* 4205, 4206, 4216, *Murata & S. F. Huang* 17611; Niitaka-Arishan-Keitao, *Sasaki* s.n. Dec. 2, 1933; Mt. Morrison, *Chuang et al.* 4039.

- Kaohsiung: Tienchih-Chinching Bridge, Wang 4230; Chinching Bridge, Wang 4235, 4236; Chinching Bridge-3026 Peak, Wang 4231; Tienchih-Yakou, Yang s.n. Sep. 4, 1986; Takuanshan, Wang 4238, 4239, 4241; South Cross Island Highway, Huang 6596.
- Pingtung: Tona, Chen s.n. Nov. 15, 1985; Ali, Wang 3448; Wutai, I. S. Chen 1577 (*pro parte*), 1602 (*pro parte*); Daisekizan, Sasaki s.n. Oct. 18, 1933; Tawushan, Kano s.n. Mar. 1929.
- Ilan: Ssuyuan, Yang s.n. Aug. 12, 1986; Ssuyuan-Nanshan, Wang 3507, 3508, 3509, 3510, 3511, 3512, 3513, 3546; Ssuyuan-710 logging tract, Wang et al. 3619; Ugan-Pianan-anbu, S. Suzuki 5030; Tuling, Yamamoto s.n. Nov. 3, 1928; Suigen-Sansyoanbu, S. Suzuki 5964; 710 Logging tract, Yang s.n. Mar. 4, 1987; 720 Logging tract, Yang s.n. Mar. 5, 1987; Chilanshan, Wang 5028, Kuo 7954; Yuanyang Lake, Huang & Yang s.n. Apr. 1986, Huang et al. 10720; Taipingshan, Yang s.n. Apr. 30, 1987, Sasaki s.n. Apr. 25, 1930, s.n. Mar. 21, 1918 (TAI) (TAIF), S. Suzuki 93, 4116, 3946, 85, s.n. Aug. 13, 1925, s.n. Jul. 1929, Huang et al. 10779, Chuang & Kao 4091.
- Hualien: Hoping logging tract, Kuo 8203, Tang s.n. May 8, 1986, 1767; Batakan, Kanehira & Sasaki s.n. May 30, 1919 (TAIF); Yenhai logging tract, Hsiao s.n. Jan. 14, 1988 (TAI) (TAIF); Mukuananshan, Hsieh & Lin s.n. Oct. 10, 1987; Kiraikei-Higasinoko, Sasaki s.n. Aug. 22, 1929; Kiraikei-Asahi, Matuda s.n. Aug. 4, 1919 (TAIF); Higasinogo-Noko, Sasaki s.n. Aug. 23, 1929; Tzuen, Y. M. Hsu 616, 617; Tayuling, Tang s.n. May 9, 1986; Tatung-Tali, Wang 2416; Chingshuishan, Huang et al. s.n. Jul. 23, 1986, Nakamura 5356, Wang 2307, Liao 248 (NTUF); Lintianshan, Lin & Lin s.n. Feb. 13, 1986; Wanrung, Lin & Lin s.n. Feb. 13, 1986; Tonogo-Kirai, Nakamura 5071; Panpien-Tienchang; T. Shimizu 11240, 11216; Luanshan, Huang 4234; Tienchang cliff, T. Shimizu 11252, Nakamura 4916; Tentyono dangai, Sakahenkirai, Nakamura 4979; Sakahen-Kiraikei, Sasaki s.n. Aug. 19, 1929.
- Taitung: Lisung-Shiangyang, Wang 2059; Shiangyang, S. Huang 1083; Shiangyang-Litao, Jeng 2627, 2633; Central Mt. Range, Mori s.n. Apr. 15, 1909 (TAIF), s.n. Dec. 1908 (TAIF); Ahisen, Central Mt. Range, Sasaki s.n. Jan. 4, 1911; Chiakankei, Mori s.n. Jan. 1908 (Type of *Viola thrichopoda*, TI!), s.n. Jan. 16, 1907 (TAIF); Chienching-Shenshan, Hosokawa 5253; Izumo, Yamamoto & Mori 466; Tokiwa-Asahi, Yamamoto & Mori 342 (*pro parte*); Tokiwa, Yamamoto & Mori 312; Kueihu, Hsu 3335, Wang 3436, 3437; Torin, Tanaka 10385 (NTUF); Dairinkosya, Mori 1845 (TAIF).

Note: The taxon was treated as conspecies with *V. rupicola* Elm. of the Philippines by many authors except Hashimoto (1959). The type specimen of *V. rupicola* Elm. is not seen, but judging from the description and examination of the specimens collected from the Philippines [Jacob 7407 (L), Steiner 2065 (L), Clemens 17810 (NTUF)], however, these two taxa are different in the flower size and the position of the stigmatic opening, although they are very similar in the foliar shape. The flowers of the Philippines species are smaller, only 9-12 mm in diameter and with a obviously protruding stigmatic opening, but the flowers of Taiwan species are larger, 15-24 mm in diameter and with an anterior stigmatic opening. The Taiwan species is distinguishable with *V. rupicola* Elm., its earliest correct name, *V. adenothrix* Hay. is accepted here.

This species is widely distributed in Taiwan, its vegetative characters, e.g.

the texture of leaf blade, vestiture, often varied with the habitat, but intermediate types are also frequently found in the intermediate habitat. Many Hayata's "specie" are now considered as infraspecific variation by us.

1b. *Viola adenothrix* var. *tsugitakaensis* (Masamune) J.C. Wang & T.C. Huang
stat. nov. 雪山堇菜 Fig. 2

Viola tsugitakaensis Masamune in Journ. Soc. Trop. Agr. 2: 240, 1930. Lin in Taiwania 1: 276, 1950. Hsieh in Li *et al.*, Fl. Taiwan 3: 782, 1977. (Syntype, Masamune 1233, TAI!)

Leaves chartaceous or subcoriaceous, slightly hirsute to almost glabrous. Lateral petals beardless or rarely bearded. Chromosome number: $n=12$.

Distribution: Endemic.

Specimens examined:

Hsinchu: Tapachienshan, Ying 4202 (NTUF).

Taichung: Hsuehshan (Mt. Tugitaka), Masamune 1233 (Type of *Viola tsugitakaensis*, TAI!), Simada 2524, Wang 4362, 4640; Tsukaoshanchuang-Hsuehshan, Mori s.n. Oct. 24, 1936 (*pro parte*); Nanhunanfeng, Wang 3575, 3578, Chen s.n. Oct. 4, 1986.

Nantou: Pass Noko, S. Suzuki s.n. Aug. 4, 1926; Hsinjenkang, Wang 3883; Hohuanshan, Wang 3415, 3417, Hayata s.n. Apr. 21, 1916 (TAIF); Kunyang-Yuanfeng, Wang 3420, 3422, 3424, Lin s.n. May. 31, 1985; Yuanfeng-Tsuifeng, Wang 5103, 5104, 5105, 5106; Chungyang Gold Mine, Wang 4288; Kwankao-Dueikuan, Wang 4297; Mt. Mabolos, Kano s.n. Aug. 1931; Monroe cliff-Tungpu, Hsu 5385.

Chiayi: Yushan, Sasaki s.n. Sept. 1, 1924, Masamune 3817, C. Tseng 4046, I. Tenaga s.n. Sept. 24, 1924; Paiyunshanchuang-Yushanchienschan, T. Y. Yang & S. S. Wu 3540; Tatachia, Yang s.n. Oct. 30, 1986; Tataka-Niitaka, Simada 840; Yushanchienschan, Hsu 4227; Tungpu-Yushanchienschan, Hsu 4002; Paiyunshanchuang-Tongpu, Huang 4584.

Kaohsiung: Tienchu-Yakou, Tang 1701; Kwanshan, Wang 4232; Kwanshanling, Yang s.n. Apr. 3, 1988.

Ilan: Nanhutashan (Nankotaizan), S. Suzuki s.n. Jul. 17, 1937, Wang 3574; Bunnakei, T. Suzuki, Fukuyama & Simada 17425, 17524, Wang 3565.

Hualien: Konankuan-Tayuling, Hsu & Kuoh 7120, 7122, 7123, 7128; Hohuanshan, Ou & Kao 9138, Wang 4308; Tyuosenzan, T. Suzuki & Fukuyama 15174; Mokkuizan, Nakamura 4656; Taosaifeng, Chen s.n. Oct. 5, 1986; Nanhutung-feng, Wang 3567, 3569, 3570, 3572.

Taitung: Yakou, Wang 4242, 4243, 4244; Yakou hostel, Jeng 2589.

Note: The variety grows on high altitude and is characterized by the thicker and almost glabrous leaf blade.

2. *Viola arcuata* Blume, Bijdr. 58, 1825; W. Becker Beih. Bot. Centralbl. Abt. 2, 34: 226, 1916; Nakai in Bot. Mag. Tokyo 33: 204, 1919 (*pro parte*); Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 30 (*pro parte*); Jacob & Moore in van Steenis, Fl. Malesiana 7: 205, fig. 14, 1971. 如意草 Fig. 3

Viola verecunda auct. plur. non A. Gray

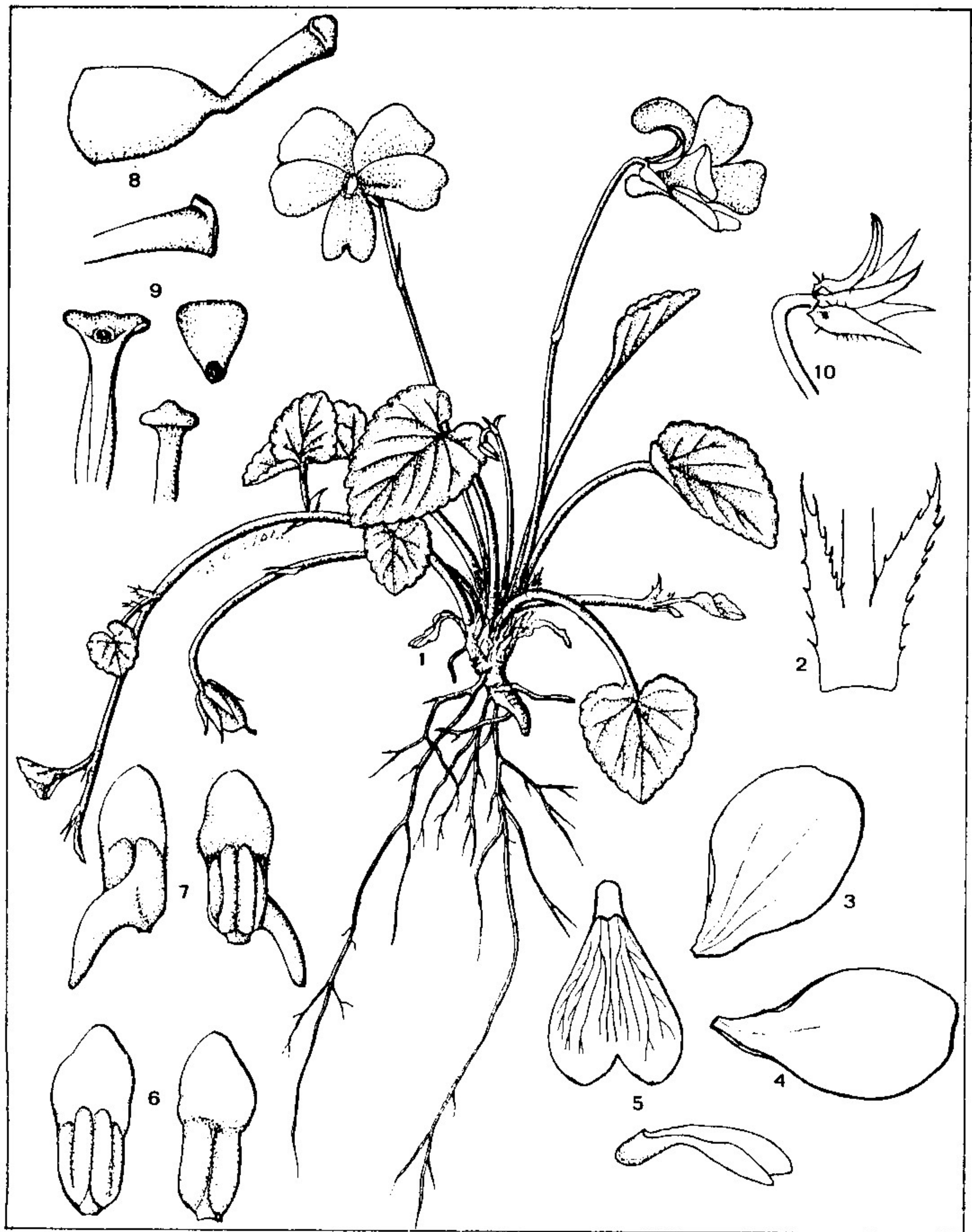


Fig. 2. 雪山堇菜 *V. adenothrix* Hayata var. *tsugitakaensis* (Masamune) J. C. Wang & T. C. Huang.

1. Habit; 2. Stipule; 3. Upper petal; 4. Lateral petal; 5. Basal petal; 6, 7. Stamens; 8. Pistil; 9. Styles; 10. Calyx.

Viola arcuata Blume var. *verecunda* (A. Gray) Nakai in Bot. Mag. Tokyo 36: 88, 1922.

Viola alata Burgersdorf ssp. *verecunda* (A. Gray) W. Becker in Beih. Bot. Centralbl. Abt. 2, 34: 227, 1916.

Viola verecunda A. Gray form. *radicans* Makino in Bot. Mag. Tokyo 27: 153, 1913. Lin in Taiwaniana 1: 277, 1950.

Viola arcuata Blume var. *verecunda* (A. Gray) Nakai form. *radicans* (Makino) Nakai in Bot. Mag. Tokyo 36: 88, 1922.

Viola verecunda A. Gray form. *hensoaensis* Kudo & Sasaki in Ann. Rep. Taihoku Bot. Gard. 1: 37, 1931. Lin in Taiwaniana 1: 277, 1950. Hsieh in Li *et al.* Fl. Taiwan 3: 784, 1977. (Holotype, Kudo & Sasaki 15640, TAI!)

Perennial herb; rhizome erect to ascending, rather stout, bearing stems and leaves at apex. Stem up to 60 cm, slender, procumbent to ascending or erect, often rooted at lower nodes. Leaves 1.2–3.5 cm long, 1.5–6 cm broad, broadly hastate, sometimes ovate or orbicular, broadly and deeply to shallowly cordate at base, with prominent basal lobes, usually converging, cuspidate to obtuse at apex, crenulate on the margin, glabrous or sparsely pubescent on both surface, herbaceous, sometimes thicker; petioles 1–14 cm long, slender. Stipules of the radical leaves brown, membranous, lanceolate, acute, slightly serrate, 6–10 mm long, 1–2 mm broad; stipules of the cauline leaves green, 4–14 mm long, 1–5 mm broad, prominent and sometimes leaf-like, lanceolate to oblong-lanceolate, acute, slightly dentate to almost entire, glabrous. Flowers small, ca. 1–1.5 cm across, white to pale purple, with darker veins; peduncles 2–15 cm long, slender. Sepals 3–5 mm long, 1–1.5 mm broad, lanceolate, acute, entire, glabrous; appendage ca. 1 mm long, rounded, glabrous. Petals oblong to oblanceolate, laterals bearded, the basal shortest, emarginate at apex; spur 1–2 mm long, equalling or slightly exceeding calycine appendages, cylindrical, obtuse. Styles 1.2–1.4 mm long, geniculate at base, clavate distally, with rounded marginal lobes at apex and conspicuously anterior stigmatic beak. Capsules 5–10 mm long, oblong, glabrous. Seeds ovoid, ca. 1.2–1.4 mm long, with inconspicuous elaiosome. Chromosome number: $n=12$.

Distribution: India, N. Burma, S. China, Indo-China, Sumatra, Java, the Philippines, Moluccas, New Guinea.

Specimens examined:

Keelung: Keelung, Sasaki s.n. Apr. 4, 1910 (TAIF).

Taipei: Yangmingshan (Sozan), Chang 081, Chuang 2720, Huang 9322, Mori s.n. May 8, 1932, Chuang & Kac 3312, Hsu & Kao 3308, Kudo, Suzuki & Mori 327, S. Suzuki 7452, Sasaki s.n. Apr. 1918 (TAIF), Tanaka 1798 (L) (NTUF), Ying 767 (NTUF); Taipei, Kawakami 1672 (TAIF), Shimada s.n. Apr. 1909 (TAIF), Simada s.n. Mar. 1908 (TAIF); Chishingshan (Mt. Sitisei), Wang 3554, 3561, S. Suzuki s.n. Mar. 21, 1928, s.n. Dec. 1, 1929, Yang 1227, Hsu 3198, Masamune s.n. Dec. 1, 1929, s.n. Dec. 26, 1929, Ying 781 (NTUF); Tsutzuhu (Chikusiko), Simada 1170, Ito s.n. Feb. 15, 1914 (TAIF), Tanaka & Shimada 13505 (L) (NTUF), Simada 60c (NTUF), Shie 1253 (TAIF); Yangmingshan-Tsutzuhu, Kao s.n. Feb. 9, 1955; Yangmingshan-Chishingshan, Hsu 3171; Neishungchi, Wang 1001; Chungshing farm, Wang 4117, 4118, 4119, Tang 1408; Eihukusyo, Sasaki s.n. Mar. 24, 1929; Tatungshan (Daitonzan), Kao 3615, S. Suzuki 7476, 7480, 10229, 10230, s.n. Nov. 30, 1930, Chen

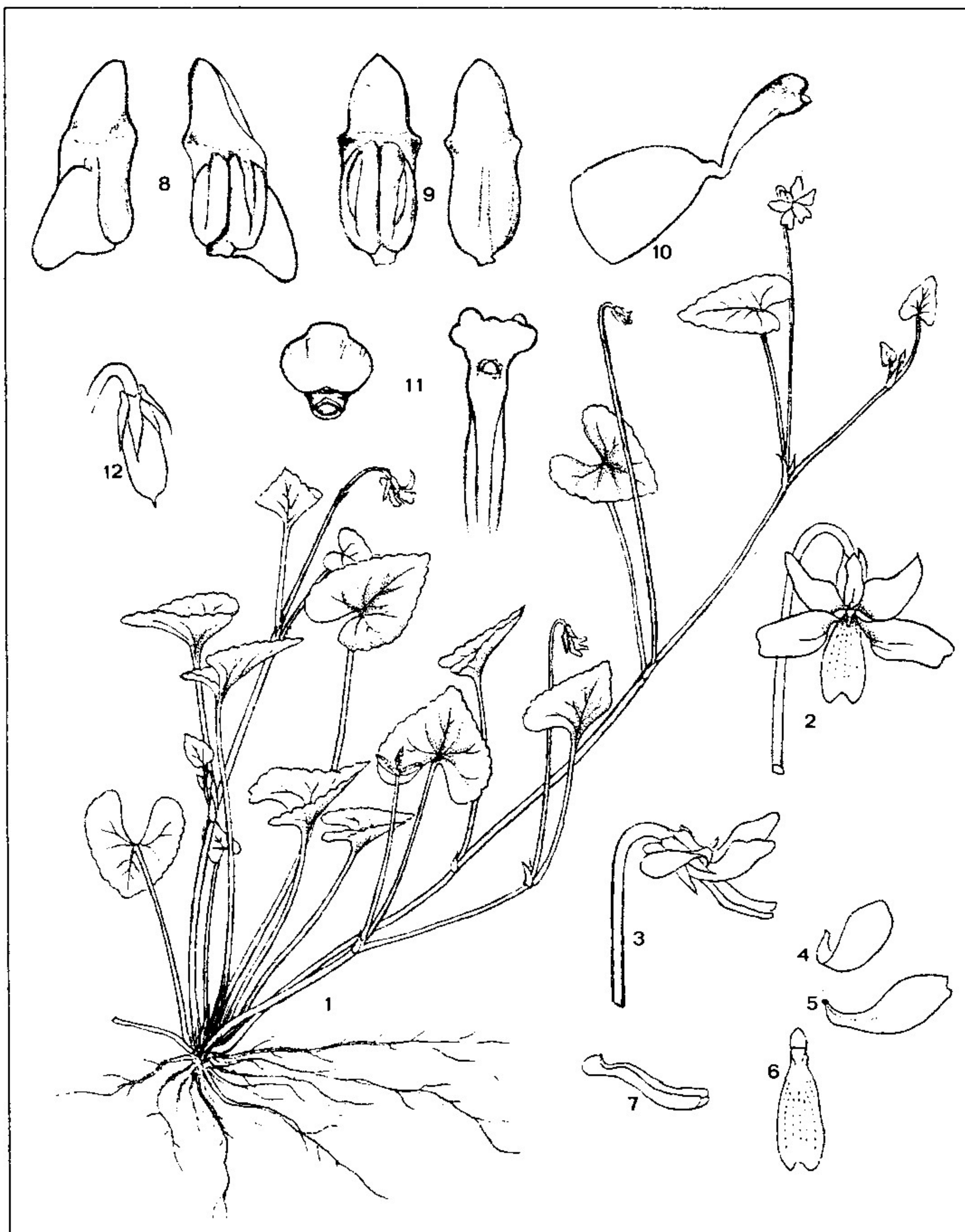


Fig. 3. 如意草 *V. arcuata* Blume

1. Habit; 2, 3. Flowers; 4. Upper petal; 5. Lateral petal; 6, 7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Styles; 12. Capsule.

2242, Chen et al. 1074, Hsu 5191, Murata & Yang s.n. Mar. 25, 1985, Sho 47, 48, T. Suzuki 8289, Shimada 4366 (TAIF); Menghuanhu, Wang 2878, 3430, Kuo 5499; Wutzushan, Kuo 9338; Mentienshan, Simada s.n. Oct. 31, 1914 (TAIF); Shamaoshan, collector unknown s.n. Feb. 6, 1909 (TAIF); Fonglin fall, Yang 1080; Tatunshan-Peishinchuang, Lin s.n. Mar. 21, 1986; Tsutzu-shan, Shimizu 2044; Fukueichao, Sasaki s.n. Mar. 24, 1924; Shantzuchao-Kueishan, Masamune & Mori s.n. Dec. 1937; Shihmen, Sasaki s.n. Mar. 25, 1924 (TAIF).

Taoyuan: Taoyuan, Masamune 3477, T. Suzuki 5840, Simada 1149, Sasaki s.n. Nov. 1923 (TAIF); Chungli, Shimada s.n. Mar. 28, 1908 (TAIF); Jenmei, Kuo 6196; Nankan, Simozawa 862, Simada 1165; Shihlangshie, Mori 2661 (TAIF); Tungluochuan, Shimada s.n. Dec. 27, 1908 (TAIF); Chiaopanshan, Mori & Simada s.n. Mar. 24, 1909 (TAIF).

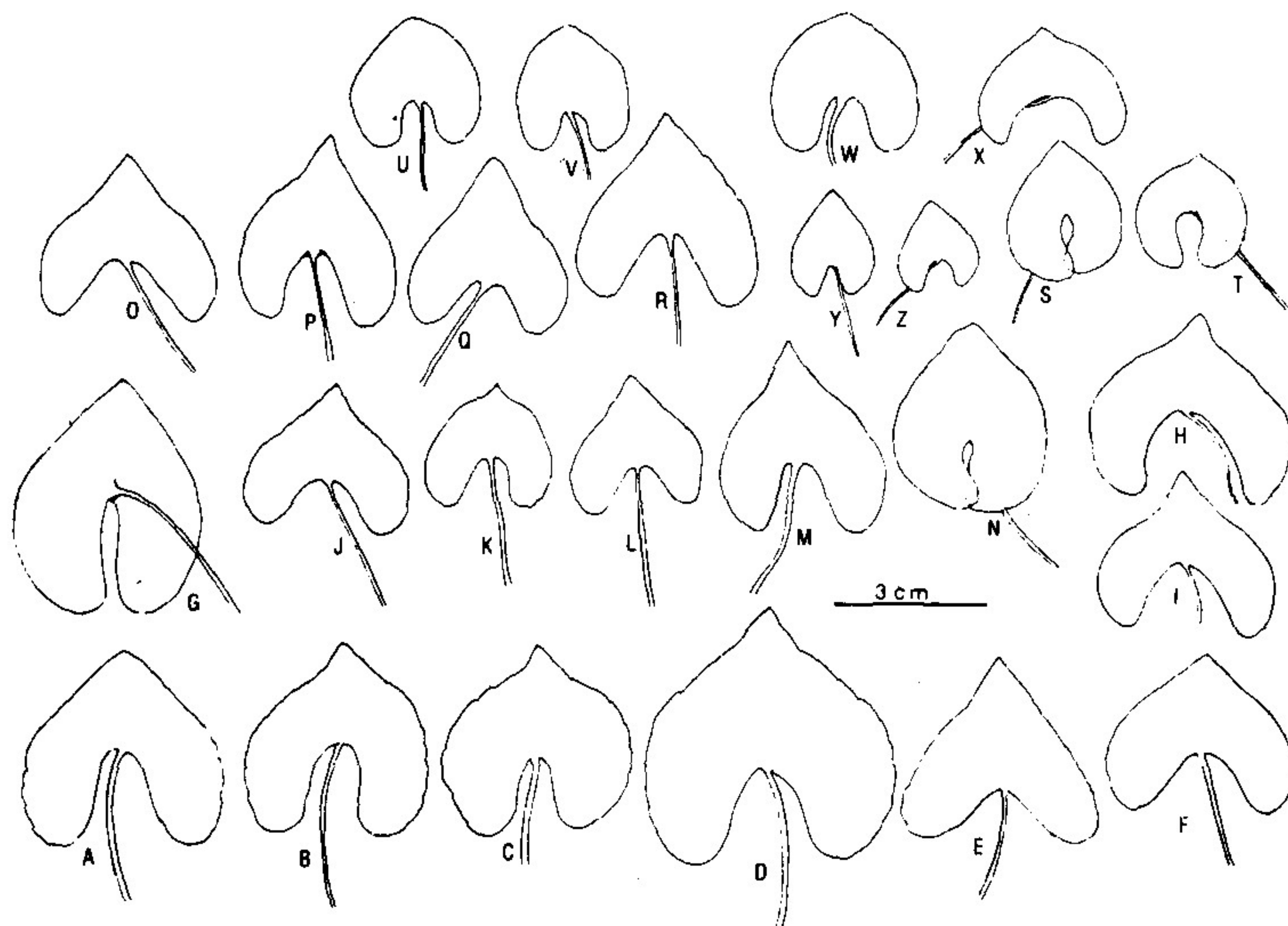


Fig. 4. The infraspecific variation of leaf blades of Taiwanese *Viola arcuata* Blume, showing the correlation with the growth elevation. A-G, Yang-mei, alt. 100 m (Wang, 4145). H-I, Yang-mei, alt. 100 m (Chen, s.n. 1985). J-L, Chung-hsing farm, alt. 750 m (Wang, 4119). M-N, Chung-hsing farm, alt. 750 m (Wang, 4118). O-R, Chi-hsing-shan, alt. 800 m (Wang, 3581). S-T, Sunmoon lake, alt. 600 m (Kudo & Sasaki, 15640, Type of *V. verecunda* form. *hensoaensis*). U-X, Shern-mi lake, alt. 1000 m (Lin s.n. 1987). Y-Z, Tsuei-feng lake, alt. 2000 m (Yang s.n. 1987). All are radical leaves except E is a cauline leaf.

- Hsinchu: Hsinchu, *Simada* s.n. Dec. 4, 1908 (TAIF); Yangmei, *Wang* 4143, 4144, 4146, *Chen* s.n. Jan. 24, 1985.
- Miaoli: Miaoli, *Sasaki*, s.n. Apr. 30, 1910 (TAIF).
- Taichung: *Kawakami* s.n. Mar. 2, 1909 (TAIF); Lishan, *Wang* 4303b.
- Nantou: Sunmoon Lake (Zitugetutan), *Kanehira & Sasaki* s.n. Mar. 10, 1918 (TAIF), *Sasaki* s.n. Sep. 12, 1929 (TAIF), *S. Suzuki* 6724, *Kudo & Sasaki* 15640 (Type of *V. verecunda* form. *hensoaensis*, TAI!)
- Ilan: Tsaopei, *Kuo* 8234, *Yang* s.n. Mar. 29, 1988, *Y. P. Yang* s.n. Apr. 9, 1977 (TAIF); Shuanlienpei, *Wang* 5066; Shernmihu, *Lin* s.n. Mar. 12, 1987. Tsueifenghu, *Yang* s.n. Apr. 30, 1987.

Note: This species belongs to the *Bilobatae* group which contains about 12 species (Becker, 1916) and chiefly distributed in the Eastern Asia, from Amur to New Zealand. All the species in this group are probably $n=12$ (Hashimoto, 1967b) and hardly distinguished each other. *V. verecunda* resembles *V. arcuata* very much and can be distinguished only by the leaf shape as well as the geographic distribution. However, leaf shape is not a stable and good character. Hirayama *et al.* (1987) pointed out that leaf shape of *V. verecunda* in Japan varied with soil nature. We also found the leaves of Taiwanese specimens seem to correlate with their growth elevation (Fig. 4). An intensive comparison of specimens in the neighbor regions is needed to clarify the two taxa. By a preliminary comparison, the authors treat them as separate species and use the name of Malesian species for our taxon, because our specimens are more similar to Malesian (*V. arcuata*) than Japanese (*V. verecunda*) specimens.

3. *Viola betonicifolia* J. E. Smith in Rees, Cyclop. 37, I, n. 7, 1817; D. M. Moore in Fedde, Rep. 68: 81, 1963; M. Jacob & D. M. Moore in van Steenis Fl. Malesiana 7: 202, 1971. 箭葉堇菜 Fig. 5

Viola betonicifolia J. E. Sm. subsp. *nepalensis* W. Becker in Bot. Jahrb. 54, Beibl. 120: 166. 1917; Merrill, Enum. Philip. 3: 105. 1923; Ooststr. & H. J. Lam in Blumea 5: 594. 1945.

Viola caespitosa D. Don, Prod. Fl. Nepal. 205. 1825; Hatusima, Fl. Ryukyus 419. 1971; Hsieh in Li *et al.* Fl. Taiwan 3: 770, pl. 810, 1977.

Viola oblongo-sagittata Nakai in Bot. Mag. Tokyo 36: 37. 1922; Lin in Taiwania 1: 278. 1950; Hashimoto in Bull. Jap. Assoc. Bot. Gard. 35, 1959. (Type, *Tashiro* s.n. Mar. 1887, TI!)

Viola betonicifolia var. *oblongo-sagittata* (Nakai) F. Maekawa & Hashimoto in Journ. Jap. Bot. 43: 162, 1968.

Viola oblongo-sagittata Nakai var. *violascens* Nakai in Bot. Mag. Tokyo 36: 37. 1922; Lin in Taiwania 1: 278. 1950. (Type, *Nakahara* s.n. Feb. 1907, TI!)

Viola patrinii (non DC) Matsumura & Hayata in Journ. Coll. Sci. Univ. Tokyo 22: 30. 1906; Kawakami, List Pl. Form. 7. 1910; Hayata, Icon. Pl. Form. 1: 61. 1911.

Viola patrinii DC. var. *chinensis* (non Ging.) Hayata, Icon. Pl. Form. 6. Suppl. 5, 1916.

Perennial herb; rhizome erect to ascending, rather stout, bearing greenish-white or yellowish roots below and rosette of leaves and flowers at apex, acaulescent. Leaves 3-16 cm long, 0.6-6 cm broad, usually linear-lanceolate to triangular-lanceolate, cuneate or truncate at base during the flowering period, and become



Fig. 5. 箭葉堇菜 *V. betonicifolia* J.E. Sm.

1. Habit; 2. Flowers; 3. Upper petal; 4. Lateral petal; 5, 6. Basal petal; 7, 8. Stamens; 9. Pistil; 10. Capsule.

triangular-hastate, truncate to hastate at base, with prominently basal lobes after flowering period, acute or sometimes roundish obtuse at apex, shallowly and distantly crenate, sometimes dentate on basal lobes, long-decurrent on petiole, glabrous or pubescent on both surfaces, herbaceous to subcoriaceous; petiole 1-15 cm long. Stipules 3-7 mm long, ca. 1 mm broad, lanceolate, acuminate, sparsely short-fimbriate, glabrous, fuscous, adnate to petiole to 3/4 length. Flowers 10-20 mm across, white to purple, with darker veins; peduncles 6-28 cm long, equalling or exceeding leaves, glabrous or pubescent. Sepals 5-9 mm long, 1-3 mm broad, ovate-lanceolate to lanceolate, acute or acuminate, entire, glabrous; appendages 1-2.5 mm long, rounded to squarish or sometimes subdentate, glabrous. Petals obovate, uppers and laterals bearded or rarely uppers beardless, the basal emarginate or truncate at apex; spurs 2-4 mm long, cylindrical, obtuse, straight or slightly upcurved. Styles 1.5-2.2 mm long, geniculate at base, clavate distally, with prominent marginal lobes at apex, anterior stigmatic beak. Capsules 7-12 mm long, oblong, glabrous. Seeds ovoid, 1.5-1.8 mm long. Chromosome number: $n=36$.

Distribution: Himalayas, India, Ceylon, China, Japan, Indo-China, Sumatra, Java, Celebes, New Guinea, Australia, the Ryukyus, the Philippines.

Specimens examined:

Keelung: Keelung, *Sasaki s.n.* Mar. 30, 1930, *Sasaki s.n.* Mar. 1913 (TAIF), *Hayata s.n.* Mar. 13, 1916 (TAIF).

Taipei: Yangmingshan (Sozan), *Wang 4200*, *Chuang 2719*, *T. Suzuki 4193*, *Ito s.n.* Feb. 15, 1914, *S. Suzuki 11804*, *s.n.* Mar. 3, 1929, *Sasaki s.n.* Feb. 15, 1914, *s.n.* Nov. 25, 1919, *s.n.* Nov. 1919 (TAIF); Tsutzuhu (Chikushiko), *Simada 1172*, *1173*, *1206*, *Tanaka & Shimada 13508*, *Sasaki s.n.* Feb. 25, 1911 (TAIF), *s.n.* Oct. 1923 (TAIF); Yangmingshan-Tsutzuhu, *Kao s.n.* Feb. 9, 1955; Tatunshan (Mt. Daiton), *S. Suzuki 7530*, *10232*, *Simada 112*, *H. Lin s.n.* Feb. 24, 1947, *Murata & Yang 17853*, *Sho 30*, *38*, *46*, *50*, *32*, *49*, *Tanaka 5363* (NTUF); Chishingshan (Mt. Sitisei), *H. Simizu 633*; Peitou, *Simada s.n.* Aug. 1917 (TAIF); Sitiseitonzan, *Simada s.n.* Apr. 2, 1910 (TAIF); Shamaoshan, *collector unknown s.n.* Feb. 6, 1909 (TAIF); Kwanyinshan (Mt. Kwannon), *Hsu s.n.* Oct. 16, 1960, *S. Suzuki 11928*, *s.n.* Feb. 2, 1930, *Masamune s.n.* Feb. 2, 1930; Tansui, *Simozawa 983*, *Simada s.n.* Mar. 3, 1907 (TAIF), *Kawakami & Simada 4269* (TAIF); Fukueichiao, *Sasaki s.n.* Mar. 24, 1924; Hsintien, *S. Suzuki s.n.* Oct. 9, 1926; Tsaoshan, *Hsu 6705*; Keelungshan, *Wang 3501*, *S.F. Huang s.n.* Jul. 2, 1985; Sekitei, *Sasaki & Fuji s.n.* Mar. 1913 (TAIF); Shihpafun, *Nakamura 4291*; Yehliu, *Wang 4219*, *Lin s.n.* Apr. 2, 1988; Hsiao-keelung, *Sasaki s.n.* Mar. 24, 1924 (TAI) (TAIF).

Taoyuan: Taoyuan, *Simada 1147*; Jenmei, *Kuo 6579*; Chonli, *Simada s.n.* Mar. 28, 1908 (TAIF).

Hsinchu: Sintiku, *Simada 1179c*, *1179b* (TAIF); Wutzushan, *Kawakami 5991* (TAIF); Yangmei, *Wang 4141*, *4142*; Kwanwu, *Wang 4124*; Kwanwu-Tzenshan, *Wang 4752*.

Taichung: Chiliang, *Kuo, Chuma & Chang 8834*; Wuling farm, *Wang 3895*; Lishan, *Wang 3050*, Sentohei, *Yasukawa s.n.* Feb. 4, 1925 (TAIF).

Nantou: Puli, *Seki 104*; Lushan, *S.F. Huang s.n.* Jan. 23, 1987; Hinokiyama, *Kawakami & Nakahara s.n.* Feb. 1906 (TAIF), *Nakahara s.n.* Feb. 1907 (Type

of *V. oblongo-sagittata* var. *violascens*, TI!); Mt. Maiseiki, *U. Mori* 3565 (TAIF), 3566 (TAIF), s. n. Jan. 9, 1907 (TAIF); Musya-Santinozyo-Miharasi, *Masamune, Mori & Nakamura* 2031; Noko-Musya, *Simada* s. n. Mar. 7, 1918 (TAIF).

Kaohsiung: Mt. Bui, *Matuda* s. n. Mar. 30, 1917 (TAIF); Tientsu, *Jeng* 2702.

Pingtung: Nanjenhu, *Chen* s. n. Apr. 10, 1986.

Ilan: Ssuyuan (Pianan-anbu), *Huang* 7308, *S. Suzuki* s. n. Oct. 23, 1928, *Sasaki* s. n. Oct. 9, 1930; 710 logging tract, *Yang* s. n. Mar. 4, 1987; 720 logging tract, *Wang* 5079, 5081, 5082, 5083, 5084, 5085, 5086, 5090, *Yang* s. n. Mar. 5, 1987; Ssuyuan-Nanshan, *Wang* 3504; Chilanshan, *Wang* 5029.

Hualien: Lilong, *Yasukawa* s. n. Feb. 18, 1923 (TAIF).

Taitung: Taisyao, *Nakahara* s. n. Jan. 1905 (TAIF); Hsinkangshan, *Yamamoto* 900; Chiakankei, *Mori* 4555 (TAIF); Mataianshi, *Mori* s. n. Apr. 20, 1909 (TAIF).

4. *Viola biflora* L., Sp. Pl. 936, 1753; W. Becker in Beih. Bot. Centralbl. Abt. 2, 36: 39, 1918; Nakai in Bot. Mag. Tokyo 36: 88, 1922; Lin in Taiwania 1: 280, 1950; Hsieh in Li *et al.* Fl. Taiwan 3: 770, pl. 809, 1977. 雙黃花堇菜 Fig. 6

Viola kanoi Sasaki in Trans. Nat. Hist. Soc. Form. 19: 104, 1929. (Type, *Kano* s. n. Jul. 16, 1929, TAIF!)

Viola tayemonii Hayata, Icon. Pl. Form. 6: 3, 1916.

Perennial herb; rhizome erect to ascending, more or less stout, bearing stems and leaves at apex. Stem up to 22 cm, slender, ascending to erect. Leaves 0.8–2 cm long, 1.5–4 cm broad, reniform to broadly ovate, more or less deeply cordate at base, rounded to obtuse at apex, subcrenate to repand-dentate on the margin, glabrous beneath and hirsute above, subcoriaceous; petioles 0.5–5 cm long, slender. Stipules 2–6 mm long, 1.5–3 mm broad, ovate to oblong, acute at apex, sparsely denticulate to almost entire, glabrous, free. Flowers 1–1.5 cm across, yellow with brownish-purple veins; peduncles 1–4 cm long, slender, exceeding leaves. Sepals 5–6 mm long, 1–1.5 mm broad, linear to linear-oblong, acute at apex, glabrous or short ciliate on margin; appendages up to 0.5 mm long, rounded, glabrous. Petals oblong to obovate, basal longest, rounded at apex, laterals beardless; spurs 1–1.5 mm long, equalling or slightly exceeding calycine appendages, cylindrical, obtuse. Styles 1.2–1.5 mm long, slightly geniculate at base, clavate distally, with two lateral lobes fused behind at apex, no stigmatic beak. Capsules 4–6 mm long, ellipsoid, glabrous. Seeds ovoid, ca. 2 mm long. Chromosome number: $n=6$.

Distribution: Circumboreal, widely distributed in the cooler regions and high mountains of the Northern Hemisphere.

Specimens examined:

Taichung: Hsuehshan, *Huang* 7255, *Masamune* 1277, *Wang* 4359, 4360, 4361, *Kano* s. n. Jul. 16, 1929 (Holotype of *V. kanoi*, TAIF!); Hsuehshanpeifeng, *Wang, Huang & Yang* 4631, 4646; Nanhunanfeng, *Wang* 3576.

Nantou: Hohuangshan, *Lin* s. n. May 31, 1985, *Wang* 5113.

Ilan: Nanhutashan, *Suzuki, Fukuyama & Simada* 17477, 17787, 18115, *Wang* 3573; Bunnakei, *Fukuyama* 4664, *Wang* 3564; Tatzousuinanshi, *Wang* 3571.

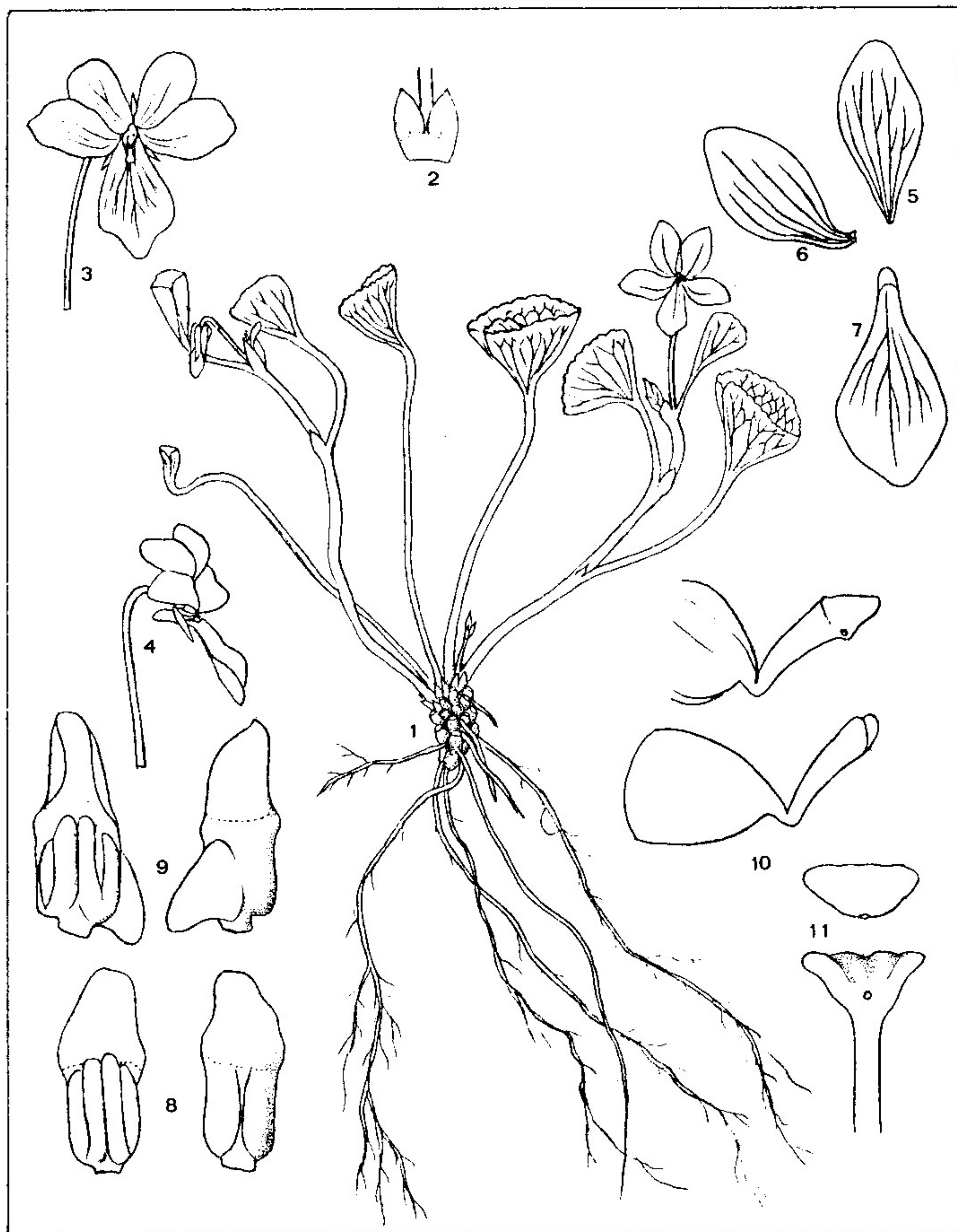


Fig. 6. 雙黃花堇菜 *V. biflora* L.

1. Habit; 2. Stipule; 3, 4. Flowers; 5. Upper petal; 6. Lateral petal;
7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Styles.

5. *Viola confusa* Champ. ex Benth. in Hook. Journ. Bot. Kew Misc. 3: 260, 1851 (*pro parte*); W. Becker in Kew Bull. 1928, 383. 短毛堇菜 Fig. 7

Viola stenocentra Hayata ex Nakai in Bot. Mag. Tokyo 36: 38, 1922; Lin in Taiwaniana 1: 280, 1950. (Syntypes, Niinami 1898, TAIIF!; Kawakami & Mori 2011, TAIIF!; Mori 1769, TAIIF!)

Viola pseudojaponica Nakai in Bot. Mag. Tokyo 42: 561, 1928; Walker, Fl. Okinawa 742, 1976. *syn. nov.*

Viola yedoensis Makino var. *pseudojaponica* (Nakai) Hashimoto in Journ. Jap. Bot. 51: 340, 1976. *syn. nov.*

Viola philippica (non Cav.) Sasaki, List Pl. Form. 298, 1928; Hsieh in Li et al. Fl. Taiwan 3: 779, 1977 (*excl. pl. 815*).

Viola japonica (non Langsdorf) Matsumura & Hayata in Journ. Coll. Sci. Univ. Tokyo 22: 29, 1906; Hayata in Journ. Coll. Sci. Univ. Tokyo 25: 52, 1908, Icon. Pl. Form. 1: 61, 1913.

Viola minor (non Makino) Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 34 (*pro parte*).

Perennial herb; rhizome erect, rather stout, bearing white or yellowish brown roots below and rosette of leaves and flowers at apex, acaulescent. Leaves 2-8 cm long, 0.8-6.5 cm broad, ovate or triangular-ovate to deltoid, deeply to shallowly cordate or reniform-cordate at base, with prominently basal lobes usually somewhat converging, obtuse to rounded at apex, round-crenate to crenate-serrate on margin, long-decurrent on petiole, glabrous or puberulent on both surfaces, herbaceous; petioles 2-25 cm long. Stipules 3-8 mm long, ca. 1 mm broad, linear-lanceolate to ovate-lanceolate, acuminate, short-fimbriate-dentate, glabrous, green to pale fuscous, adnate to petiole to 3/4 length. Flowers 12-20 mm across, violet or purple; peduncles 5-16 cm long, equalling or exceeding leaves, glabrous or puberulent. Sepals 3.5-9 mm long, 1-2 mm broad, ovate-lanceolate to lanceolate, acute or acuminate, entire, glabrous or ciliolate; appendages 1-2 mm long, incised, denticulate to nearly rounded, glabrous or pubescent. Petals obovate to oblanceolate, laterals bearded or beardless, the basal emarginate or truncate at apex; spurs 3.5-6 mm long, much exceeding calycine appendages, slender, cylindrical, laterally compressed, obtuse, straight or slightly curved. Styles 1.4-2 mm long, geniculate at base, clavate distally, with prominent marginal lobes at apex, anterior stigmatic beak. Capsules 6-10 mm long, ellipsoid, glabrous. Seeds ovoid, 1.2-1.4 mm long. Chromosome number: $n=12$.

Distribution: S. China, Indo-China, Java, the Philippines, the Ryukyus.

Specimens examined:

Keelung: Keelung, Kawakami s.n. Feb. 29, 1913, Lin & Lin s.n. Mar. 11, 1988. Hayata s.n. Mar. 10, 1916 (TAIF), Sasaki s.n. Mar. 1913 (TAIF); Hopingtao, Wang 3497, 3498, Tang 281.

Taipei: Taipei, Sasaki s.n. Feb. 25, 1927, s.n. Mar. 10, 1916, A. T. Hsieh s.n. Mar. 1923 (TAIF); Daigaku-nodyo, S. Suzuki 10073; NTU Campus, Wang 3431, 3432, 5070; Sizangan, Nonaka & Mori s.n. Apr. 2, 1933, Simada s.n. Oct. 18, 1914 (TAIF); Mutzushan, Wang 3043; Suigenchi, S. Suzuki 7721, s.n. Mar. 18, 1928, Simizu 193; Santyori, T. Suzuki 4028; Oyayubi, S. Suzuki 12200; Shirin, Fuji s.n. Mar. 1913 (TAIF); Dingpeitou, Simada s.n. Dec. 13, 1914

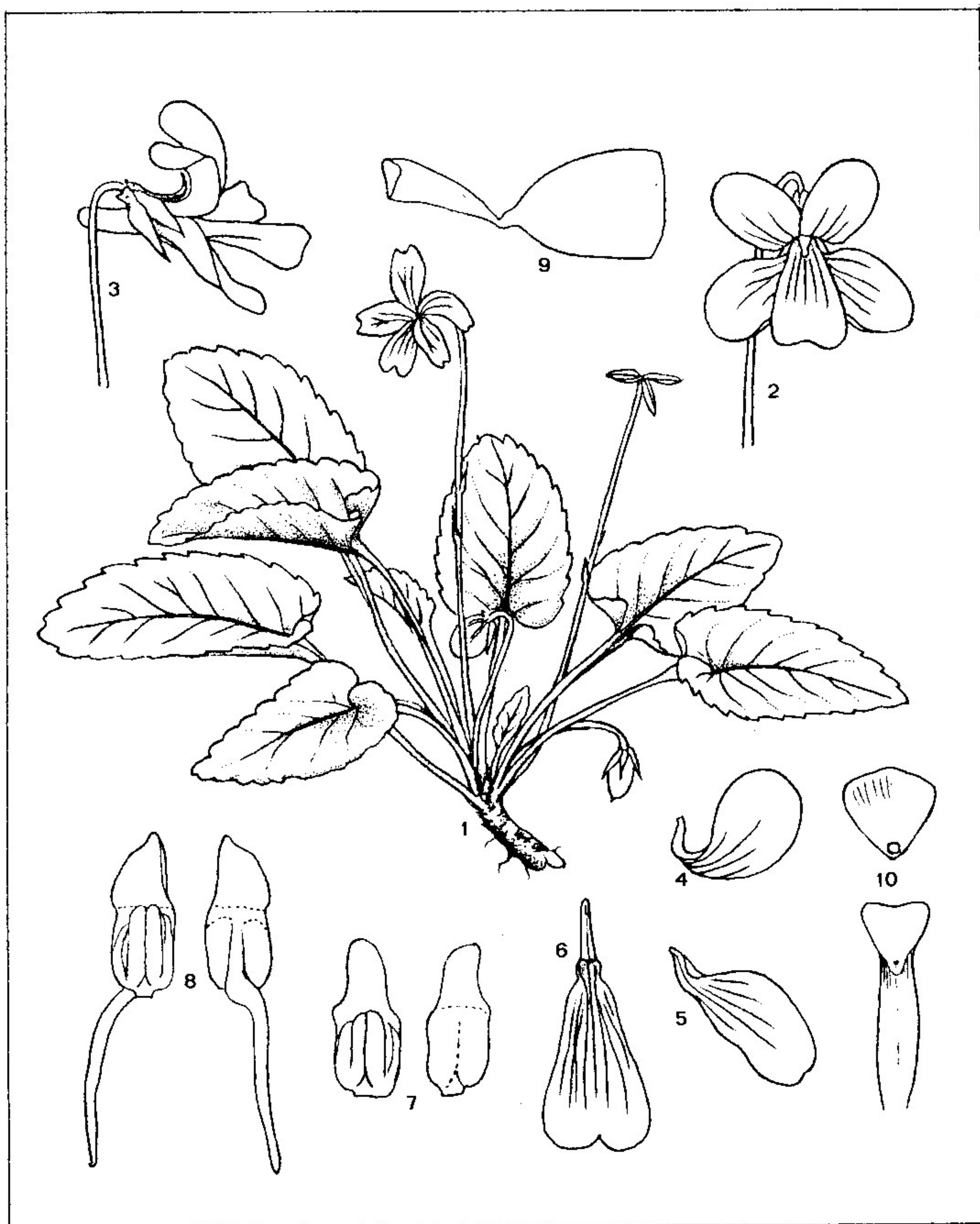


Fig. 7. 短毛堇菜 *V. confusa* Champ. ex Benth.

1. Habit; 2, 3. Flowers; 4. Upper petal; 5. Lateral petal; 6. Basal petal; 7, 8. Stamens; 9. Pistil; 10. Styles.

- (TAIF); Tsutzuhu, *Kawakami & Sasaki s. n.* Feb. 25, 1911 (TAIF); Yangming-shan, *Simada s. n.* Oct. 1913 (TAIF), *Sasaki s. n.* Nov. 1919 (TAIF); Tatunshan, *T. Suzuki 6777, 6768, S. Suzuki 10202, Sasaki s. n.* Dec. 1908 (TAIF); Mohen, *S. Suzuki 6103*; Nankang, *Nakamura 4272*; Tomi-to-cho, *Tanaka 13483* (TAI) (NTUF); Pachina, *Niinami 1898* (Type of *Viola stenocentra*, TAIF!); Lungdong *Tang s. n.* Mar. 11, 1988; Yenliao, *S. F. Huang s. n.* Mar. 11, 1988; Tatunshan-Peihsinchuang, *Lin s. n.* Mar. 21, 1986; Sansya, *Wang 3472, 5076*; Pass Sorei, *S. Suzuki 9225*; Pinglin, *H. N. Yang 1478*; Urai, *Wang 3586, Sasaki s. n.* Jan. 1913 (TAIF); Fulung, *Wang 881*; Yehliu, *Wang 4221, 4222, 4220, Kuo 6104*; Hsiao-keelung, *Sasaki s. n.* Mar. 24, 1924 (TAIF); Shihmen, *S. H. Lin 705, Huang 8274*; Tansui, *Simada 1189, H. N. Yang 2276, Kawakami & Simada 4263* (TAIF); Mentienshan, *Simada s. n.* Oct. 31, 1914 (TAIF); Kwanyinshan, *S. Suzuki 11929, Simada s. n.* Jan. 6, 1915 (TAIF); Shihting, *Sasaki s. n.* Mar. 1913 (TAIF); Huangdidien, *Wang s. n.* Jun. 2, 1985.
- Taoyuan: Chiaopanshan, *Mori & Simada s. n.* Mar. 24, 1909 (TAIF); Hsutzoukang, *Sakaki s. n.* May 11, 1908 (TAIF); Tawanping, *Mori s. n.* Mar. 16, 1906 (TAIF); Amuping, *Mori 2695 (pro parte)* (TAIF); Chonli, *Kao 10182*; Nankan, *T. Suzuki 3535, 3536*.
- Hsinchu: Lidungshan, *Chen s. n.* Mar. 8, 1987; Sintiku, *Ohnema 59, Simada 1183e* (NTUF); Wutzushan, *Kawakami s. n.* Dec. 1904 (TAIF), *s. n.* Apr. 1906 (TAIF); Kuansi, *Yang s. n.* Mar. 1, 1987.
- Miaoli: Miaoli, *Huang 13017, Sasaki s. n.* May 3, 1908 (TAIF); Naiwan, *Sasaki s. n.* May 4, 1908 (TAIF); Tahu, *Wang 5078*.
- Taichung: Ensyurin, *S. Suzuki s. n.* Dec. 13, 1922; Mt. Hassen, *S. Suzuki s. n.* Oct. 22, 1929; Lishan, *Kao 5074*; Tapan, *Kuo 7679*; Kukuan-Chingshan, *T. Y. Yang 1390*; Chingshan, *Wang 3488, 5059*; Jiayang, *Wang 5061*; Wuling Farm, *Wang 4335, 3896*.
- Changhua: Yuanlin, *Kawakami s. n.* Mar. 2, 1907 (TAIF).
- Nantou: Chitou, *Cheng s. n.* Mar. 2, 1968; Chingshuikou, *Huang, Kou & Kao 773*; Tungpu, *Jeng 2491*; Tungpu-Futsu cliff, *Yang s. n.* Mar. 29, 1986; Wushie, *Mori 4534* (TAIF), *S. F. Huang s. n.* Jan. 21, 1987, *s. n.* Jan. 22, 1987, *S. Suzuki s. n.* Jan. 31, 1922, *I. M. Liu 43* (NTUF); Wuchie, *Hsu 11337*; Musya-Santinozyo, *Masamune, Mori & Nakamura 1980*; Lushan, *Wang 4197, S. F. Huang s. n.* Jan. 23, 1987; Hoshe 25th Comp., *C. C. Kuo 252* (NTUF); Hoshie tract, *Huang 2181, 2212*.
- Chiayi: Alishan, *Huang & Kao 1613*; Tsutouchi, *Simada s. n.* Dec. 19, 1906 (TAIF); Hsiehchihlu-Fushan, *Yang s. n.* Jan. 16, 1987; Mt. Niitaka, *Kawakami & Mori 2011* (Type of *Viola stenocentra*, TAIF!); Tappansya, *Mori 1769* (Type of *Viola stenocentra*, TAIF!).
- Kaohsiung: Rikiriki-Kikamon, *Kudo & Mori 2884*; Hakuhyo, *S. Suzuki 7134*; Sehshan, *Huang 6479*; Meishan, *Wang 4228*; Fanshuliao, *Mori 3104* (TAIF), *s. n.* Nov. 31, 1907 (TAIF).
- Pingtung: Ali, *Wang 3450*; Naibun-Suigenchi, *Kudo & Mori 1522*; Hengchun, *Ito, s. n.* Mar. 1914 (TAIF); Kuraru, *Kudo & Suzuki 15883*; Garanbi, *Kawakami & Nakahara 858* (TAIF); South Cape, *Kudo & Suzuki 15752*; Kuskus, *Kudo & Suzuki 19961*; Nanjenshan, *Yang 308*.
- Ilan: Suao, *Sasaki s. n.* Dec. 10, 1921, *Kawakami s. n.* Feb. 27, 1914 (TAIF); Tungao, *Hsieh et al. s. n.* Mar. 14, 1987, *Wang 5063*; Ugan-Pianan-anbu, *S.*

Suzuki 5029; Kinyan-Piyahau, *S. Suzuki* 6378; Wushihbi, *S.F. Huang et al.* 3713.

Hualien: Hualien, *Huang* 4965; Tienhsiang, *T. Shimizu & Kao* 10627; Lintien-shan, *Peng* 2617.

Taitung: Hachiriwan-Kioish, *Yamamoto* 899; Hsinkangshan, *Yamamoto* 903; Shihningpu, *Yamamoto* 896; Palishi, *Yamamoto* 897; Kibisha, *Yamamoto* 2207; Taito-chiyo, Tokiwa, *Tanaka* 10308 (NTUF); Tzoushishie, *Mori s.n.* Dec. 6, 1905 (TAIF); Karenwan, *Nakahara* 700 (TAIF); Chiakankei, *Mori s.n.* Jan. 17, 1907 (TAIF); South Cross Island Highway, *S. Huang* 1089; Litao-Tienlung Bridge, *Wang* 4270; Central Mt. Range, *Mori s.n.* Dec. 1908 (TAIF); Ahisen, Central Mt. Range, *Kawakami & Sasaki s.n.* Jan. 1, 1910 (TAIF); Lanyu, *Huang et al.* 10651.

Note: The species is characterized by its slender spur. Becker's treatment of nomenclature (Becker, 1928) is accepted here.

6. *Viola diffusa* Ging. in DC., Prodr. 1: 298, 1824; Diels in Bot. Jahrb. 29: 477, 1901; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 23: 52, 1886; Matsumura & Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 22: 28, 1906 (Enum. Pl. Form.); Hayata, Icon. Pl. Form. 1: 60, 1911; W. Becker in Philip. Journ. Sci. 19: 713, 1921; Merrill, Enum. Philip. Fl. Pl. 3: 105, 1923; Masamune in Taiwan 1: 69, 1948; Lin in Taiwan 1: 270, 1960; Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 30; Jacob & Moore in van Steenis, Fl. Malesiana 7: 202, 1971 (*pro parte*); Hsieh in Li *et al.* Fl. Taiwan 3: 773, *excl. pl.* 811, 1977. 茶匙黃 Fig. 8

Viola kiusiana Makino in Bot. Mag. Tokyo 16: 138, 1902; *ibid.* 19: 73, 1905.

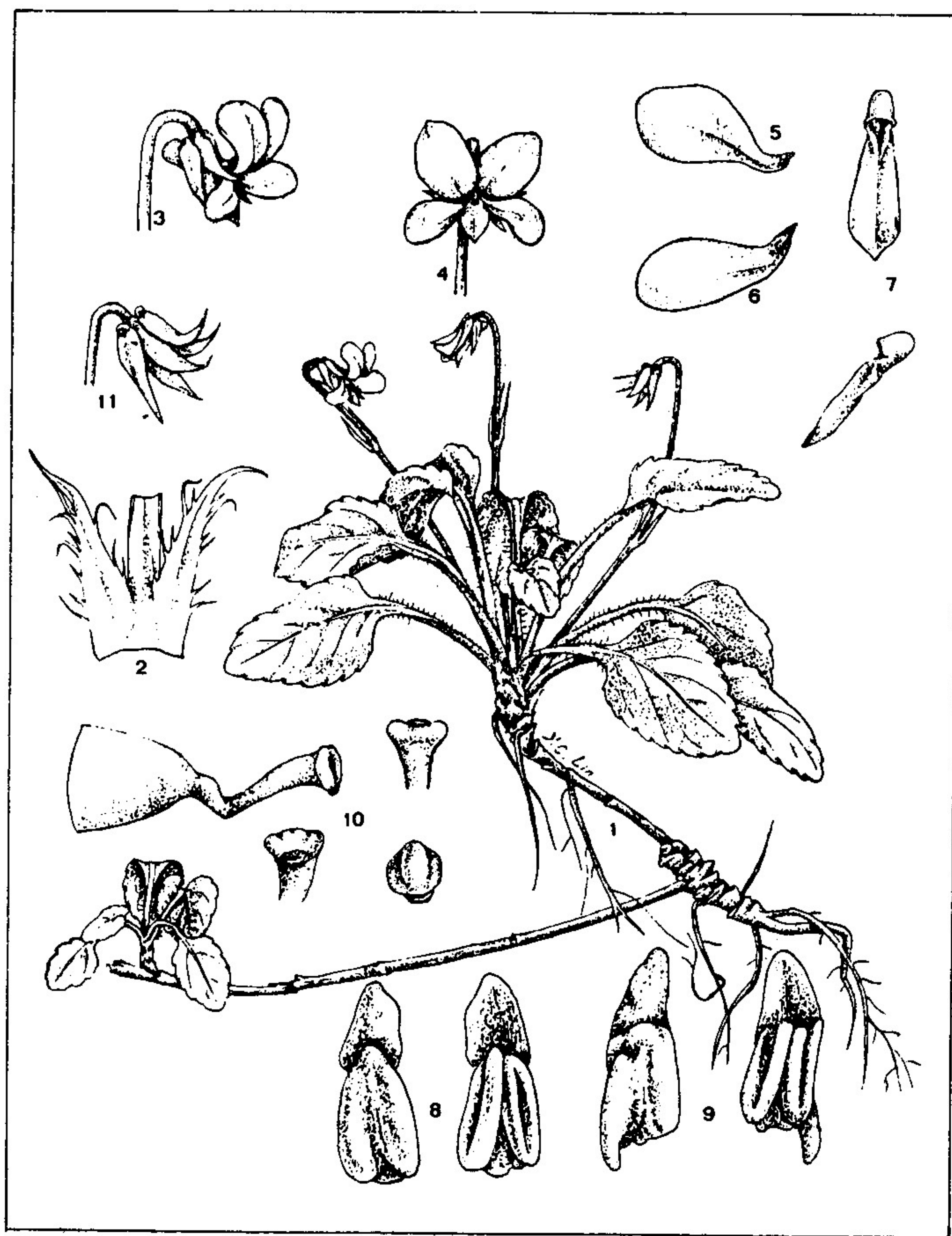
Viola diffusa Ging. var. *glabella* Boiss. in Bull. Herb. Boiss, II. 8: 742, 1908; Lin in Taiwan 1: 272, 1950.

Perennial herb; rhizome erect to ascending, rather thin, fibrillose, bearing rosette of leaves and flowers and procumbent rooting stems at apex. Stems up to 38 cm, rooting at ends and producing dense rosettes of leaves and flowers. Leaves 1-4 cm long, 1-3 cm broad, smaller on stolons, suborbicular to ovate or elliptic, cuneate to shallowly cordate at base, subacute to rounded or obtuse at apex, crenate to serrate-crenate on margin, long decurrent on petiole, hirsute or rarely glabrous, herbaceous; petioles 1-7 cm long. Stipules 5-9 mm long, 1-1.5 mm broad, lanceolate to ovate-lanceolate, acuminate at apex, dentate to ciliate on margin, free. Flowers 7-13 mm across, pale violet to almost white; peduncles 1.5-7 cm long, exceeding leaves. Sepals 3-6 mm long, 1-1.5 mm broad, lanceolate, acute at apex, sparsely pubescent, fimbrio-ciliate on margin, green; appendages up to 0.5 mm long, rounded, fimbrio-ciliate. Petals obovate, the basal shortest, acute at apex, laterals bearded; spurs 0.5-1 mm long, obtuse. Styles ca. 1.2 mm long, geniculate at base, clavate distally, with two lateral lobes at apex, anterior stigmatic beak. Capsules 4-6 mm long, ellipsoid, glabrous. Seeds ovoid, ca. 0.8 mm long. Chromosome number: $n=13$.

Distribution: Himalayas, India, China, Indo-China, S. Japan, the Ryukyus, the Philippines and New Guinea.

Specimens examined:

Keelung: Keelung, *Sasaki s.n.* Mar. 1913 (TAIF).

Fig. 8. 茶匙黄 *V. diffusa* Ging

1. Habit; 2. Stipule; 3, 4. Flowers; 5. Upper petal; 6. Lateral petal;
7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Calyx.

- Taipei: Taipei, *Sasaki s.n.* Mar. 11, 1908 (TAIF); Yangmingshan, *C. Chen s.n.* May 17, 1985; Chishingshan, *Ying 773* (NTUF); Tsutzuhu, *Ito s.n.* Feb. 15, 1914 (TAIF), *Kawakami & Yosi s.n.* Feb. 25, 1911 (TAIF); Luchiaoken, *Ho 210* (NTUF); Pitan, *Chuang 2585*; Wantan, *Shimizu 2070, 2316*; Hsintien, *S. Suzuki s.n.* Oct. 9, 1926; Pitanshan, *Shimizu 2117*; Peihsinchuang, *Ou & Kao 9273*; Tatunshan-Peihsinchuang, *Lin s.n.* Mar. 21, 1986; Huangtitien, *Wang 3372, 4344, s.n.* Jun. 2, 1985; Urai Wang 3585; Hsiaokotou-Lutsutan, *Hsu 6520*; Chuchih, *Sasaki s.n.* Apr. 3, 1915 (TAIF); Jiajouling, *Mori s.n.* Mar. 11, 1906 (TAIF); Sanhsia, *Sasaki s.n.* Nov. 23, 1909 (TAIF); Kueishan, *Simada 994*; Rimogan, *T. Suzuki 18459, Kawakami & Mori 5068* (TAIF); Kasinokihira, *S. Suzuki 6299*; Keelungshan, *Wang 3500*; Seikitei, *Sasaki & Fuji s.n.* Mar. 1913 (TAIF).
- Taoyuan: Wuliao, *Mori 2673, Kawakami & Mori 3653*; Paling-Tamanshan, *Yang 1282*; Ssuling-Paling, *Wang 3532*.
- Hsinchu: Wutzushan, *Kawakami 5990* (TAIF).
- Miaoli: Tahu, *Simada 4003, Sasaki s.n.* May 6, 1908, *s.n.* May 5, 1908 (TAIF).
- Taichung: Sentangping, *Sasaki s.n.* Feb. 5, 1925; Chingshan, *Wang 5058*; Chingshan-Kukuan, *Wang 2972, 3489*; Wuling farm, *Wang 3897, 4339*; Kukuan, *H. C. Chen s.n.* Mar. 13, 1986.
- Changhua: Yuanlin, *Kawakami s.n.* Mar. 1907 (TAIF).
- Nantou: Chitou tract, *Chuang et al. 3282* (TAI) (NTUF); Rengechi, *Kwan 92*; Kwantauchi, *Hsu & Kuoh 10608, 10622, 10651, Wang 4199*; Shanlinshi, *Yang s.n.* 1986; Lushan, *S. F. Huang s.n.* Jan. 23, 1987; Tongpu-Dueikuan, *Wang 4277, 4278, 4279*; Dueikuan-Kwankao, *Yang s.n.* Oct. 22, 1986; Chingshuikou, *Huang 1009* (TAI) (NTUF); Musya-Santinozyo, *Masamune, Mori & Nakahara 1988*; Hoyosha, *Kanehira & Sasaki s.n.* Mar. 9, 1918 (TAIF); Tungpu-Futzu cliff, *Yang s.n.* Mar. 29, 1986.
- Chiayi: Tatachia, *Tsann 42*; Chiaoliping, *Hayata s.n.* Mar. 27, 1914 (TAIF); Funchihu, *Hayata s.n.* Mar. 27, 1914 (TAIF); Alishan, *Hsu & Kuoh 6858*.
- Kaohsiung: Mt. Bui, *Matuda s.n.* Mar. 30, 1917 (TAIF); Weiliaoshan, *Yamada 28*.
- Pingtung: Wutai, *I. S. Chen 1559*; Ssuchungshi, *Sasaki s.n.* Feb. 1910.
- Ilan: Yappitu-Ryohen, *S. Suzuki 6008*; Rumoan-Sikikun, *S. Suzuki 4929*; Kinyan Piyahau, *S. Suzuki 6377*; Kankei-Koro, *S. Suzuki 5883*; Sikikun-Ugan, *S. Suzuki 4978*; Tuchang-Sikilin, *Chang 245*; Shuanglienpei, *Wang 5065, 5068*.
- Hualien: Mukuashan, *Nakamura 4432*; Tongli, *S. Suzuki 1595*; Namakoyama, Taroko, *S. Suzuki 10559*; Tongli-Panpien, *collector unknown 1627*; Shashi logging tract (Chingshuishan), *Huang et al. s.n.* Jul. 23, 1986; E-W cross island highway, *T. S. Hsieh 36* (TAIF).
- Taitung: Feng-Chiachidai, *Yamamoto & Mori 96*; Litao, *Wang 4269*; Litao-Tienlung Bridge, *Wang 4271, 4272*; Tienlung Bridge, *Wang 4273, 4274*; Torin, *Tanaka 10386* (NTUF); Lanyu, *Kawakami & Sasaki s.n.* Jul. 1911.

7. *Viola formosana* Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 22: 28, 1906.

7a. *Viola formosana* var. *formosana*.

臺灣堇菜 Fig. 9

Viola formosana Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 22: 28, 1906; Icon. Pl. Form. 1: 59, 1911; Lin in Taiwania 1: 275, 1950. (Type, *Kawakami 58 TI!*)

Viola tozanensis Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 25: 53, 1908; Icon. Pl. Form. 1: 59, 1911. Lin in Taiwaniana 1: 274, 1950.

Viola formosana Hayata var. *tozanensis* (Hayata) Hsieh in Li et al. Fl. Taiwan 3: 776, pl. 813, 1977.

Viola arisanensis W. Becker in Fedde, Rep. 17: 314, 1921.

Perennial herb; rhizome erect, short, stout, bearing rosette of leaves and flowers at apex, usually with long stolons, the stolons rooting at ends and producing dense rosettes of leaves and flowers. Leaves 1–3 cm long, 1–3 cm broad, broadly cordate to orbicular, deeply cordate at base, acute to rounded or obtuse at apex, crenate on margin, wingless, glabrous to slightly pubescent, sometimes pillose at the sinus between the crenae, glaucous or greenish-violet beneath, chartaceous; petioles 1–10 cm long, glabrous or slightly pilose. Stipules 3–5 mm long, 0.5–1.2 mm broad, lanceolate, acuminate at apex, fimbriate or laciniate on margin, almost free. Flowers 14–22 mm across, violet to almost white with darker veins; peduncles 4–15 cm long, slender, usually much exceeding leaves, glabrous or sparsely pilose. Sepals 3–5 mm long, 0.5–1.5 mm broad, lanceolate, obtusely acuminate at apex, entire, glabrous; appendages ca. 1 mm long, squarish, glabrous. Petals ovately cuneate, the basal longest, deeply emarginate at apex, uppers and laterals beardless, truncate at apex; spurs slender, 5–7 mm long, exceeding calycine appendages, cylindrical, obtuse. Styles 1.2–1.6 mm long, geniculate at base, thickened distally, apex slightly lobed on both sides, with inconspicuously anterior stigmatic beak. Capsules 4–6 mm long, globose to ellipsoid, glabrous. Seeds ovoid, ca. 1 mm long. Chromosome number: $n=11$.

Distribution: Endemic.

Specimens examined:

Taipei: Wantan, Kawakami 58 (Type of *V. formosana*, TI!); Habun, Yang s.n. Sep. 27, 1986; Kankou, Lin & Shen s.n. May 27, 1933; Rimogan, Kawakami & Mori 2674 (TAIF); Urai, Wang 3587; Tataoshan, Chen s.n. Oct. 19, 1986; Lopeishan, Wang 5073, 5074, 5077, Hsieh et al. s.n. Apr. 4, 1986; Polushan, Chen s.n. Aug. 19, 1986; Peichatienshan, Wang 3467, 3470, 3471, Lin s.n. Jan. 20, 1986, Kuo 2651; Kwaishan-Lalashan, Simozawa 888; Ruggyahu Kyutu, T. Suzuki 16074; Karashan, S. Suzuki 6215, 6252; Daitozan, Urai, T. Suzuki 6359; Taran, Kaitin Mangan, T. Suzuki 17845; Kamiyodani, S. Suzuki 6293; Tonroku, Yamamoto & T. Suzuki s.n. Mar. 20, 1936; Kaboshan, Fukuyama ST19236, T. Suzuki 12940; Togokei, Sihoyanzan, T. Suzuki 14573; Buta-Riyohen, T. Suzuki 7553.

Taoyuan: Lalashan, Hsieh et al. s.n. Apr. 17, 1986, Kuo 4792, Huang 7670, Kao 10201, Peng 1110; Paling-Lalashan, Jeng 844; Sotenzan, T. Suzuki 4671; Taiwanpin, Mori s.n. Mar. 16, 1906 (TAIF); Mt. Yuku, Simada s.n. Mar. 11, 1906 (TAIF); Tsutuan, Wang 3542; Tsutuan-Ssuling, Wang 3520, 3522, 3523, 3524; Gaotai, Kanehira s.n. Apr. 6, 1918 (TAIF).

Hsinchu: Mt. Yura, Simada 2389c; Mt. Tentana, Shimada s.n. Apr. 6, 1918 (TAIF); Mt. Gakokitu, Kawakami & Watanabe s.n. Apr. 1906 (TAIF).

Miaoli: Shihtoushan, A. T. Hsieh s.n. Dec. 14, 1929 (TAIF).

Taichung: Chungyangchienshi-Nanhushi, Wang 3582.

Nantou: Tsueifeng-Hohuanshan, Ying 1759 (NTUF).

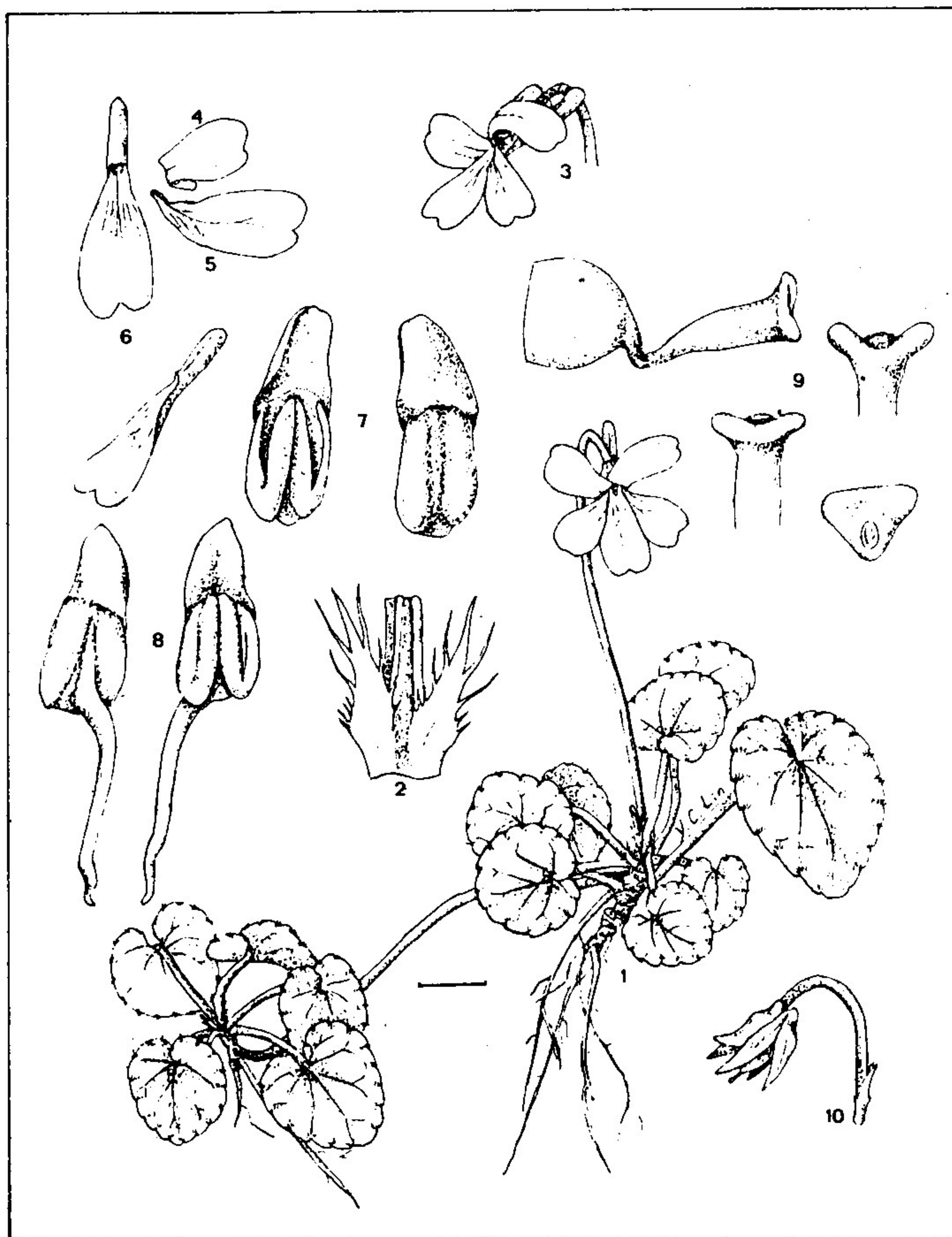


Fig. 9. 臺灣莖菜 *V. formosana* Hayata var. *formosana*

1. Habit; 2. Stipule; 3. Flower; 4. Upper petal; 5. Lateral petal;
6. Basal petal; 7, 8. Stamens; 9. Pistil; 10. Calyx.

Chiayi: Alishan, Wang 4206, 4215, Ishizaki s.n. Jun. 3, 1925, Chao & Kao 6190, Chen s.n. May 9, 1987, S. H. Chen s.n. Jan. 26, 1986, Yang s.n. Jan. 14, 1986, Soma s.n. Jan. 2, 1915 (TAIF), Sasaki s.n. May 1913 (TAIF); Erhwanping, Hayata s.n. Apr. 2, 1914; Hsiaotashan, Wang 4211, 4212; Alishan-Tashan, Wang 4210.

Kaohsiung: Kwanshan, Wang 4233.

Ilan: Taipingshan, S. Suzuki 421, 4118, Huang et al. 10781, Sasaki s.n. Mar. 10, 1918, s.n. Apr. 25, 1930, s.n. Jan. 3, 1917 (TAIF); Tayenshan, Kao 3225; Mt. Egiri, Mori s.n. Apr. 11, 1908 (TAI) (TAIF), Kawakami & Mori s.n. Apr. 11, 1908 (TAIF); Yuanyang Lake, Wang 5012, Hsu & Kuoh 14526, Huang & Yang s.n. Apr. 1986, Huang et al. 10732, 10750, 10755, 10756; Chilanshan, Wang 5025, 5026, 5027, Kuo 7847, 7849, 7855, 7857; Ssuyuan (Pianan-anbu), Wang 5089, Yang s.n. Aug. 12, 1986, Yamamoto s.n. Nov. 3, 1928; Ssuyuan-Nanshan, Wang 3505, 3506; Sankyaku-Suigen, S. Suzuki 5939; Suigen-Sansyoanbu, S. Suzuki 5963; 710 logging tract, Wang et al. 3596, Yang s.n. Mar. 4, 1987; 720 logging tract, Wang 5087, Yang s.n. Mar. 5, 1987; Chilieting-Nanshan, Chen s.n. Oct. 6, 1986; Shernmihu, S. H. Lin s.n. Mar. 12, 1987.

Hualien: Chingsuishan, Huang et al. s.n. Jul. 23, 1986, Shimizu & Kao 11884, Wang 2309, Liao 223 (NTUF); Tatung-Tali, Wang 2406.

Taitung: Taririkusya, Sasaki s.n. Feb. 25, 1925; Peinantzushan, Kano s.n.; Mt. Seikoo, Yamamoto 2209, 2210, 2211; Hsinkangshan, Yamamoto 902, 904; Sinsuiei, Sasaki s.n. Nov. 1, 1920 (TAIF).

7b. *Viola formosana* Hayata var. *stenopetala* (Hayata) J. C. Wang, T. C. Huang & T. Hashimoto *comb. nov.* 川上氏堇菜 Fig. 10

Viola kawakamii Hayata var. *stenopetala* Hayata, Icon. Pl. Form. 3: 27, fig. 13, 1913. (Syntype, Hayata s.n. Jan. 24, 1912, TI, photo!)

Viola kawakamii Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 25: 52, 1908; Icon. Pl. Form. 1: 58, 1911; *ibid.* 3: 27, fig. 12, 1913; in Journ. Coll. Sci. Imp. Univ. Tokyo 30: 33, 1911; Lin in Taiwania 1: 274, 1950. (Syntypes, Nagasawa 649, TI! KYO, photo! Kawakami & Mori 2010, TI!)

Viola hypoleuca Hayata, Icon. Pl. Form. 3: 26, fig. 11, 1913. (Syntype, U. Mori s.n. Apr. 1910, TI, photo!)

Viola matsudai Hayata, Icon. Pl. Form. 10: 1, 1921. (Syntype, Matsuda 285, TI!, TAI!)

Viola takasagoensis Koidz. in Acta Phytotax. Geobot. 7: 112, 1938.

Viola formosana (non Hayata) Hsieh in Li et al., Fl. Taiwan 3: 773, pl. 812, 1977.

Leaves 1.5–4 cm long, 1–4 cm broad, triangular-cordate, acute at apex; petiole up to 15 cm long. Chromosome number: $n=11$.

Distribution: Endemic.

Specimens examined:

Taipei: Tanorei, T. Suzuki 7406.

Hsinchu: Mt. Rokudyo, Simada 2526b; Madalashi-99 Hostel, Hsu & Kuoh 13974, Wang 4121; 99 Hostel, Hsieh 1289; Luchangtashan, Fukuyama 3409; Kwanwu, Wang 4904.

Miaoli: Nanchuang, Ponglaichun, Hsu 12654; Tahu, Kawakami, Hayata & Mori 75 (TAIF).

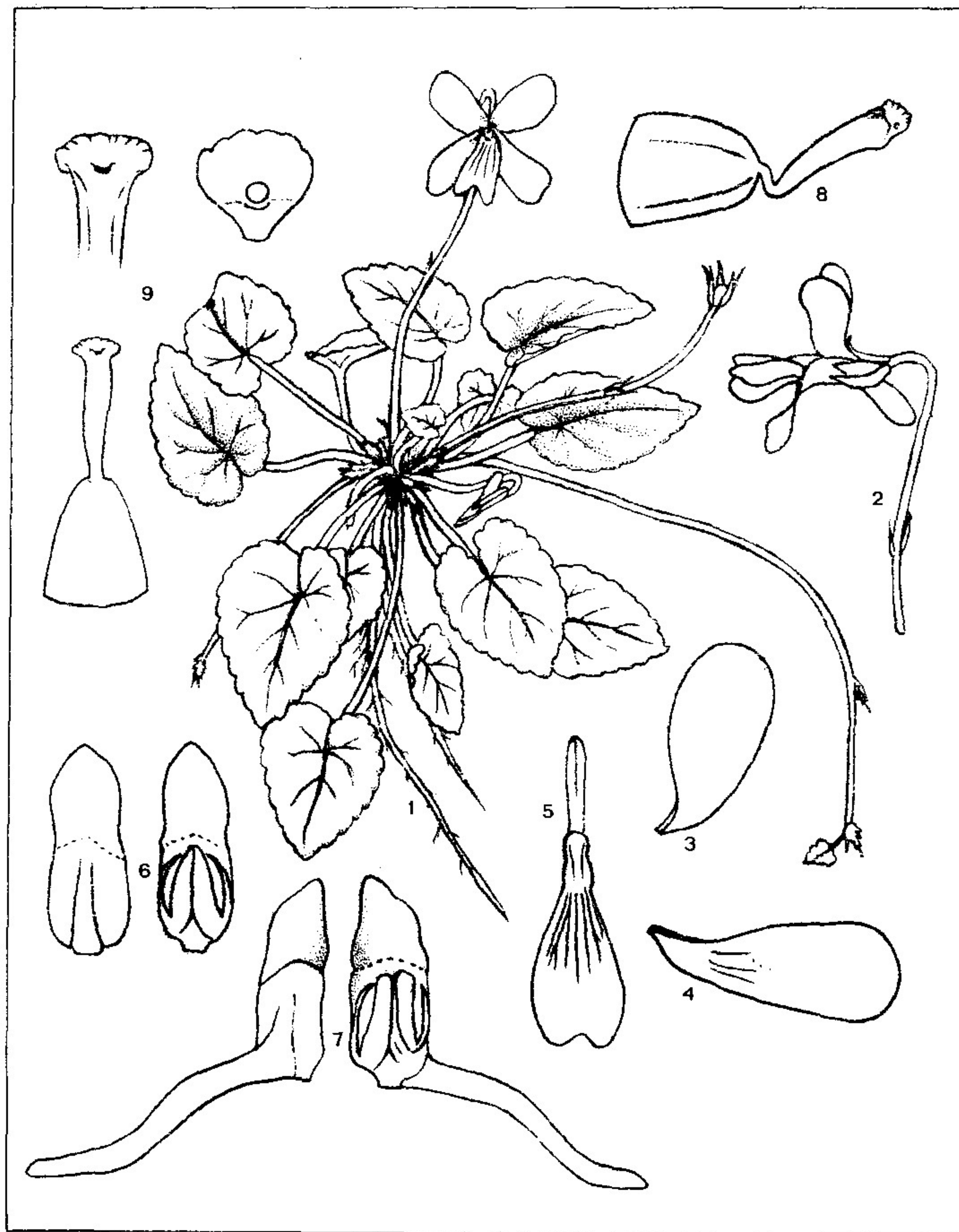


Fig. 10. 川上氏堇菜 *V. formosana* Hayata var. *stenopetala* (Hayata) J.C. Wang, T.C. Huang & T. Hashimoto.

1. Habit; 2. Flower; 3. Upper petal; 4. Lateral petal; 5. Basal petal; 6, 7. Stamens; 8. Pistil; 9. Styles.

- Taichung: Chingshan, *Wang* 2973, 3487, 3492, 3495, 5057, *S. F. Huang* 1389; Gukuan-Chingshan, *Murata* 17586; Anmashan, *Huang* 8072, *Wang* 4936; Mt. Hassen, *S. Suzuki* 2918, s. n. Oct. 22, 1929, s. n. Oct. 23, 1929, *T. Suzuki* 5614, *Sasaki* s. n. Dec. 1928; Huangzoushi, *Hayashi* s. n. Mar. 1, 1923 (TAIF).
- Nantou: Chitou, *Hayata* s. n. Apr. 12, 1916, *Yang* s. n. Jan. 29, 1986; Chitou-Chiti, *Kao* 7209; Fenghuangshan, *Kao* s. n. Feb. 14, 1955, *Chuang, Kou & Kao* 3198 (TAI) (NTUF); Chingshuikou, *Huang, Kou & Kao* 1027, s. n. Feb. 19, 1959 (TAI) (NTUF); Rengechi, *Hibino & Suzuki*, s. n. Jul. 18, 1936, *Yamamoto & Kudo* s. n. Jul. 5-6, 1930, *Yamamoto & Mori* s. n. Nov. 2-3, 1932; Mt. Meiyen, *Kao* 6694; Lushan, *S. F. Huang* s. n. Jan. 23, 1987; Musya-Santinozyo, *Masamune, Mori & Nakamura* 2434; Sunmoon lake, *Wang* 4198, *Simada* s. n. Aug. 2, 1906 (TAIF); Tongpu-Dueikuan, *Wang* 4276, 4280; Tongpu-Lolo, *Simada* 917; Lolo-Dueikuan, *S. H. Chen* s. n. Jul. 6, 1985, *Wang* 4299; Dueikuan-Kwankao, *Yang* s. n. Oct. 22, 1986; Luantashan, *Kawakami, Hayata & Mori* s. n. Aug. 9, 1907 (TAIF).
- Chiayi: Alishan, *S. F. Huang* 2494, *Yamamoto & Mori* s. n. Nov. 5, 1932, *Hashioka* s. n. Nov. 5, 1932, *Sasaki* s. n. Oct. 1928, s. n. Mar. 15, 1910, s. n. Mar. 1910 (TAI) (TAIF), s. n. Mar. 14, 1911 (TAIF), s. n. May, 1913 (TAIF); Suizan, *Nagasawa* 649 (Type of *V. kawakamii*, TI!); in Monte Morrison, *Kawakami & Mori* 2010 (Type of *V. kawakamii*, TI!); Funchihu, *Sasaki* s. n. Mar. 29, 1914, *Murata & S. F. Huang* 17656, *Hayata* s. n. Mar. 29, 1914, *S. F. Huang* 2594; Erhwanping, *Yang* s. n. Jan. 15, 1986, *Hayata* s. n. Apr. 2, 1914 (TAIF); Usyoko, Alishan, *S. Suzuki* s. n. Jan. 26, 1922; Tsushan, Alishan, *Wang* 4214; Shihshan, *Yamada* YD44; Hotapu, *Sasaki* s. n. Dec. 14, 1930.
- Tainan: Dadungshan, *Yang* s. n. Dec. 13, 1986.
- Kaohsiung: Buizan, *Y. Matsuda* 285 (Types of *Viola matsudai*, TAI!, TI!), *Sasaki* s. n. Mar. 2, 1920 (TAIF); Tientsu-Chinching Bridge, *Wang* 4229; Kwanshan, *Wang* 4234; South cross island highway, *Wang* 4237, *Ying* 1057 (NTUF); Tungi, *Hsu* 14284; Lungchien-Shinanshan, *Yamamoto & Mori* YM733; Daikwanshan, *Sasaki* s. n. Oct. 20, 1933.
- Pingtung: Ali, *Wang* 3451; Chiaokuolachih, *Wang* 3447; Tona, *Wang* 4136, 4137, 4138, *Chen* s. n. Nov. 15, 1986; Wutai, *I. S. Chen* 1577 (p. p.); Peitawushan, *Wang* 2142, 2187, *H. N. Yang* 2063; Kunanau, *Sasaki* s. n. Oct. 28, 1935.
- Ilan: Sansyo-anbu-Yappitu, *S. Suzuki* 5986; Taipingshan, *Huang* 3952; Mt. Egiri, *Mori* 5; Dangai, Rutogun, *Sasaki* s. n. Oct. 26, 1928; Sikikunsya, *S. Suzuki* s. n. Oct. 23, 1928.
- Hualien: Taroko-Tali, *Wang* 2257; Shashi logging tract, *Huang et al.* s. n. Jul. 23, 1986; Lintianshan, *Lin & Lin* s. n. Feb. 13, 1986; Wanrung, *Hsieh et al.* s. n. Apr. 4, 1987; Mukuananshan, *Hsieh & Lin* s. n. Oct. 10, 1987; Takimi-Kirisato, *Sasaki* s. n. Aug. 26, 1929; Panpien-Chilai, *Nakamura* 4913, 4915; Antung, *Kao* 6143; Ziriwa, *Matuda* s. n. Aug. 5, 1918; Mt. Simizu (Chingshuishan), *Nakamura* 5728; Sui-dan Forest, Taroko, *S. Suzuki* 9680, 9928.
- Taitung: Kueihu, *Wang* 3435, 3438a, *Hsu* 3357, 3358; Sinsuiei, *Sasaki* s. n. Mar. 21, 1932, *T. Suzuki* 8013, *Kudo & Mori* 2715, 2716, 2749, *Mori* s. n. Apr. 23, 1906 (TAIF), *Kawakami & Mori* 2851 (TAIF); Sisuiipo, *Sasaki* s. n. Mar. 21, 1932, s. n. Mar. 22, 1932; Taririkusya, *Sasaki* s. n. May 1924 (TAIF); Chien-ching-Shenshan, *Hosokawa* 5237; Shinkangshan, *Chen* s. n. Feb. 2, 1986, *Wang* 4505; Tawu, *Chuang* 3458; Duluanshan, *Yamamoto* 894, 895; Mt. Rontabun,

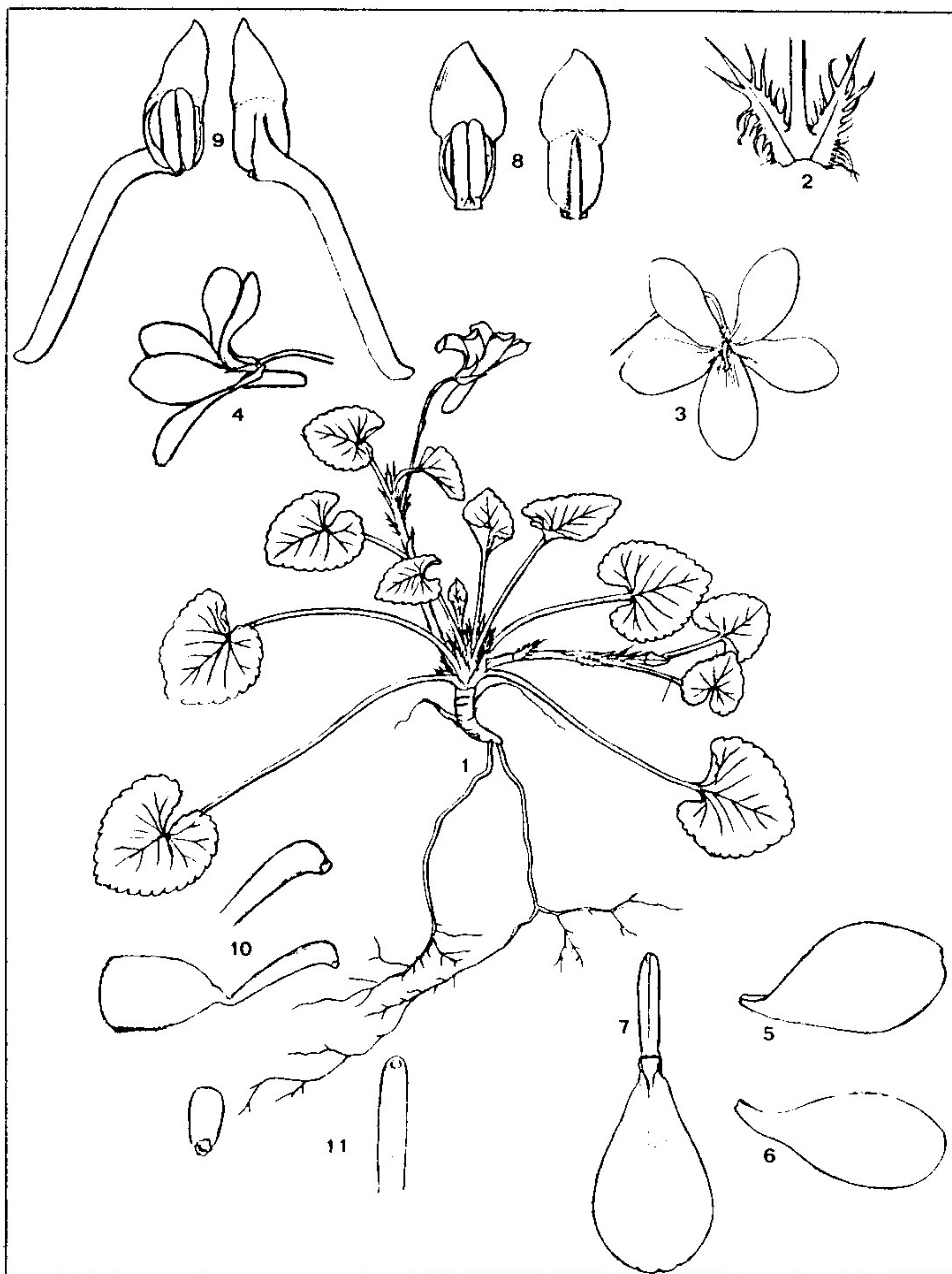


Fig. 11. 紫花堇菜 *V. grypceras* A. Gray

1. Habit; 2. Stipule; 3, 4. Flowers; 5. Upper petal; 6. Lateral petal;
7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Styles.

Mori s. n. Apr. 1910 (TAIF); Ahisen, Central Mt. Range, *Kawakami & Sasaki* s. n. Jan. 1, 1910 (TAIF).

8. *Viola grypoceras* A. Gray in Narr: Perry's Exped, 2, Append. 308, 1856; W. Becker in Beih. Bot. Centralbl. 40: 40, 1923; Hashimoto in Ann. Tsukuba Bot. Gard. 6: 4, 1987. 紫花堇菜 Fig. 11

Viola acuminata (non Ledebour) Kao & Chiu in Quart. Journ. Chinese Forest. 11: 119, 1978. *syn. nov.*

Perennial herb; rhizome horizontal to erect, more or less stout, bearing stems and leaves at apex. Stem up to 15 cm, ascending to erect. Leaves 1–2.5 cm long, 0.9–2.8 cm broad, broadly ovate, cordate-ovate or rarely cordate-reniform, cordate at base, acute or rarely obtuse at apex, depressed crenate on margin, glabrous or sparsely pubescent on both surfaces, herbaceous to chartaceous; petioles 1–10 cm long, slender. Stipules 5–10 mm long, ovato-lanceolate to lanceolate, acuminate at apex, fimbriate-laciniate on margin, glabrous, free. Flowers 1.5–2.5 cm across, light purple; peduncles 4–11 cm long, slender, exceeding leaves. Sepals 3–6 mm long, 0.8–1.2 mm broad, lanceolate, acute at apex, entire, glabrous; appendages 0.5–1 mm long, rounded or squarish, glabrous. Petals obovate, ca. 6 mm broad, basal longest, rounded at apex, the laterals beardless; spurs (3)–4–7 mm long, yellowish green, much exceeding calycine appendages, cylindrical, obtuse. Styles 3 mm long, slightly geniculate at base, filiform, apex gently hooked, stigmatic opening terminal. Capsules 5–7 mm long, ellipsoid, glabrous. Seeds ovoid, ca. 1.2 mm long. Chromosome number: $n=10$.

Distribution: China, Korea, Japan, the Ryukyus.

Specimens examined:

Taipei: Yangmingshan, *Sasaki* s. n. Jan. 1936; Taitungshan-Peihsinchuan, *Lin* s. n. Mar. 21, 1986.

Taichung: Lishan, *Wang* 3052, 3474, 4133, 4301; Wuling farm, *Chiu* s. n. Mar. 5, 1976 (*as Viola acuminata*); Chungyangchienshi, *Wang* 3579, 3583.

Nantou: Pilushi, *Wang* 2616, 2617, 3076, 3128, 3480, 4129, *Tang* 1293, *Yang* s. n. Nov. 8, 1986; Wushe, *Sasaki* s. n. Jul. 28, 1922.

Ilan: Nanhutashan, *Sasaki* s. n. Oct. 27, 1928, s. n. Oct. 1928; Ssuyuan (Pianan-anbu), *Huang* 7324, *Wang* 3503, 5080, *Sasaki*, s. n. Oct. 9, 1930; 720 logging tract, *Yang* s. n. Mar. 5, 1987; Nanshan, *Chen* s. n. Oct. 6, 1986.

9. *Viola inconspicua* Blume subsp. *nagasakiensis* (W. Becker) J. C. Wang & T. C. Huang *comb. nov.* 小堇菜 (新擬中名) Fig. 12

Viola mandshurica W. Becker ssp. *nagasakiensis* W. Becker in Beih. Bot. Centralbl. Abt. 2, 40: 161. 1923.

Viola confusa Champ. ex Benth. ssp. *nagasakiensis* (W. Becker) F. Maekawa & Hashimoto in Journ. Jap. Bot. 43: 161. 1968.

Viola patrinii DC var. *minor* Makino in Bot. Mag. Tokyo 6: 50, 1892.

Viola minor (Makino) Makino in Bot. Mag. Tokyo 26: 151. 1912; Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 34 (*pro parte*).

Viola taiwaniana Nakai in Bot. Mag. Tokyo 36: 38. 1922; Lin in Taiwania 1: 278. 1950. (Type, s. coll. s. n. Apr. 19, 1902, TAIF!)

Perennial herb; rhizome erect to ascending, rather stout, bearing white or yellowish roots below and rosette of leaves and flowers at apex, acaulescent. Leaves 2-6 cm long, 1-3 cm broad, broadest at base, triangular-ovate, cordate at base with prominently rounded basal lobes, acute at apex, crenate, sometimes dentate on basal lobes, short-decurrent on petiole, glabrous or pubescent on both surfaces, herbaceous; petioles 2-13 cm long. Stipules 3-5 mm long, ca. 1 mm broad, lanceolate, acuminate, sparsely denticulate, glabrous, adnate to petiole to 3/4 length. Flowers 8-12 mm across, purple to pale purple, with darker veins; peduncles 5-15 cm long, equalling or exceeding leaves, glabrous or pubescent. Sepals 3-5 mm long, 1-1.6 mm broad, ovate-lanceolate to lanceolate, acute or acuminate, entire, glabrous; appendages 1-2.5 mm long, rounded, acute, or sometimes incised, glabrous. Petals obovate, the laterals bearded, the basal emarginate or truncate at apex; spurs 2-2.5 mm long, exceeding calycine appendages, cylindrical, obtuse, straight. Styles ca. 1.5 mm long, geniculate at base, clavate distally, with prominent marginal lobes at apex, anterior stigmatic beak. Capsules 6-9 mm long, ellipsoid, glabrous. Seeds ovoid, 1-1.2 mm long. Chromosome number: $n=24$.

Distribution: The species in Himalayas, Burma, China, China, Sumatra, Malay peninsula, Java, the Philippines, the subspecies in Japan and Taiwan.

Specimens examined:

Taipei: Taipei, *Nakahara* s.n. Jun. 1906 (TAIF); Yangmingshan (Sozan), *Wang* 4201, *C. Chen* s.n. May 17, 1985, *S. Suzuki* 11802, *Sasaki* s.n. Feb. 9, 1923, *Ito* s.n. Feb. 15, 1914 (TAIF); Yangmingshan-Tienmu, *Wang* 3243; Yangmingshan-Peitou, *Kuo* 2900; Shamaoshan, *Simada* s.n. Jan. 1, 1919 (TAIF); Tsutzuhu (Tikusiko), *Sasaki* s.n. Feb. 16, 1930, *Simada* s.n. Apr. 3, 1931, s.n. Jan. 3, 1914 (TAIF); Tatumshan (Mt. Daiton), *Sasaki* s.n. Apr. 26, 1931, *Y.F. Chen et al.* 1072, *Simada* 4367 (TAIF); Suigenti, *S. Suzuki* s.n. May 12, 1929, s.n. Jun. 3, 1929; Chihnankung, *Hsu* 3098; Muchia, *Masamune* 2875; Toutingli Zoo, *Kuo* 10096; Chingmeishan, *Wang* 2730, 3007; Muchi, *T. Y. Chiang* 300; Tomitocho, *Tanaka* 13483; Chianchen, *Kao* 3838; Hsintien, *Wang* 4139; Pitan, *Simizu* 2118; Wantan, *Simizu* 2454; Kankou, *Huang* 8669; Hsiaokotou-Lutsutan, *Hsu* 6545; Hsiaokotou-Kankou, *Hsu* 5210; Kankou tract, *Hsu & Kao* K3547; Urai, *Tang* s.n. Apr. 29, 1987, *Kudo*, *Suzuki & Mori* 411, *S. Suzuki* 10132; Jiajouling (Kakiurei), *Kawakami & Mori* 2667 (TAIF); Shihting, *Wang* 4343; Kwanyinshan, *Simada* s.n. Jan. 10, 1915 (TAIF); Peihsinchuang, *Ou & Kao* 9274; Tansui, *Sasaki* s.n. Mar. 10, 1923, *H.N. Yang* 2277, *Simada* s.n. Mar. 3, 1907 (TAIF), *Yamasaki* s.n. Jul. 1923 (TAIF); Yehliu, *Wang* 4217, 4223, 4223b; Ryukeinaisho, collector unknown s.n. Apr. 19, 1902 (Type of *Viola taiwaniana*, TAIF!); Hsiaokeelung (Syokirun), *Sasaki* s.n. Mar. 24, 1924; Juifang, *Kou & Kao* 4506; Keelungshan, *Wang* 3499, 3502; Tsutaushan, *Soma* s.n. Feb. 1915 (TAIF).

Taoyuan: Jenmei, *Kuo* 6580; Bokungshan, *Mori* 2695 (*pro parte*) (TAIF).

Hsinchu: Bankai, *T. Suzuki* 4661; Sintiku, *Simada* 1183c; Kwanwu, *Wang* 4125; Wuchihshan, *Kawakami* s.n. Apr. 1906 (TAIF).

Miaoli: Miaoli, *Simada* s.n. Mar. 23, 1908 (TAIF).

Taichung: Kukuan, *Huang* 10327, *H.C. Chen* s.n. Mar. 13, 1986; Chingshan, *Wang* 2975 (*pro parte*).

Nantou: Musya, *Mori* s.n. Jan. 9, 1907 (TAIF).

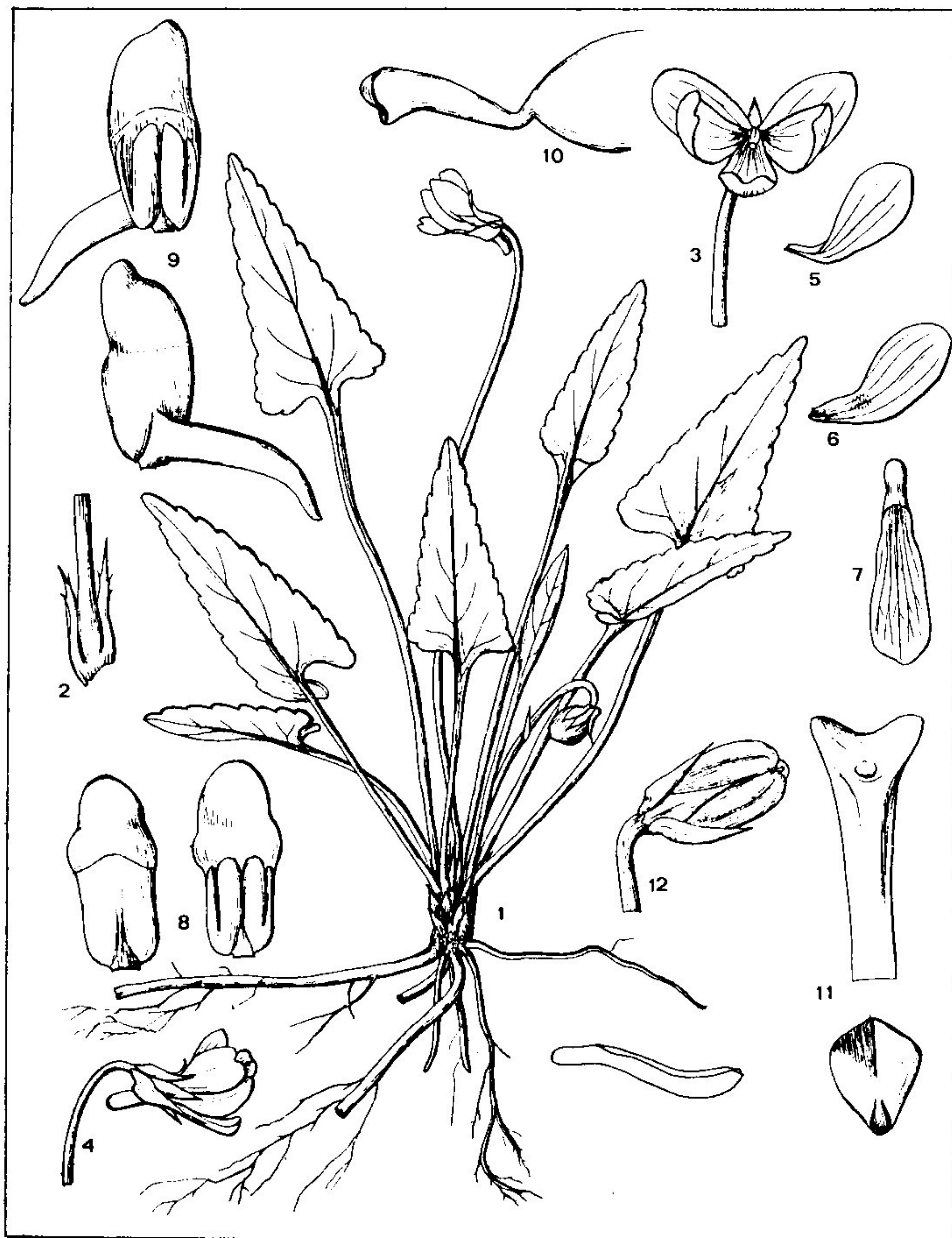


Fig. 12. 小堇菜 *V. inconspicua* Blume ssp. *nagasakiensis* (W. Becker) J.C. Wang & T.C. Huang.

1. Habit; 2. Stipule; 3, 4. Flowers; 5. Upper petal; 6. Lateral petal; 7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Styles; 12. Capsule.

Tainan: Tainan, *Yasukawa* s. n. Oct. 31, 1922 (TAIF).

Kaohsiung: Sanpin, *Huang* 10711; Mt. Bui, *Matuda* s. n. Mar. 30, 1917 (TAIF), s. n. Dec. 30, 1920 (TAIF).

Pingtung: Towarunsya-Santeimon, *Matuda* s. n. Jul. 8, 1920 (TAIF); Botansya, *Kudo & Mori* 2439; Kuskus, *Kudo & Suzuki* 1596, *Sasaki* s. n. Apr. 1910 (TAIF).

Ilan: Tungao, *Hsieh et al.* s. n. Mar. 14, 1987; Shuanlienpei, *Wang* 5067; Ilan, *S. Suzuki* 3600; Heirinbi, *Kawakami & Fuji* s. n. 1914 (TAIF).

Hualien: Batakan-Taroko, *Sasaki* s. n. Apr. 27, 1917 (TAIF).

Taitung: Taito, *Kawakami* s. n. Apr. 1905 (TAIF); Tsoushishie, *Mori* s. n. Dec. 6, 1905 (TAIF); Kasyoto, *Nakahara* s. n. Feb. 1905 (TAIF).

Note: The taxon is previously treated as a subspecies of *V. confusa* (Maekawa & Hashimoto, 1968) which is very similar to *V. inconspicua*. The latter differs with the former by the shorter spur (2-3 mm), the longer calycine appendages (2-5 mm) and bearded lateral petals, those of *V. confusa* are 4-7 mm, 1-2 mm and beardless respectively. However, our taxon is similar to *V. confusa* in calycine appendages but more similar to *V. inconspicua* in spur length and beardness. It is reasonable to transfer the taxon as a subspecies of *V. inconspicua*.

10. *Viola mandshurica* W. Becker in Bot. Jahrb. 54, Beibl. 120: 179. 1917; Lin in *Taiwania* 1: 279. 1950; Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 34; Hsieh in *Li et al.* Fl. Taiwan 3: 776, pl. 814, 1977.

Viola mandshurica W. Becker var. *ciliata* Nakai in Bot. Mag. Tokyo 36: 60. 1922; Suzuki in Masamune, Short Fl. Form. 142. 1936; Lin in *Taiwania* 1: 279. 1950.

Viola mandshurica W. Becker var. *glabra* Nakai in Bot. Mag. Tokyo 36: 60. 1922; Lin in *Taiwania* 1: 279. 1950.

Viola oblongo-sagittata Nakai form. *ishizakii* Yamamoto in Journ. Soc. Trop. Agr. Taihoku 5: 352. 1933. (Type, *Ishizaki* s. n. Jun. 3, 1924, TAI!)

Perennial herb; rhizome erect to ascending, rather stout, bearing dark brown roots below and rosette of leaves and flowers at apex, acaulescent. Leaves usually linear-lanceolate or oblong, 3-8 cm long, 0.5-1.6 cm broad, with cuneate base during the flowering period, and become triangular-lanceolate, 3-11 cm long, 1-2.5 cm broad, with truncate base and more or less enlarged basal lobes after flowering period, acute or obtuse at apex, shallowly and distantly crenate on margin, sometimes dentate on basal lobes, usually long-decurrent on petiole, glabrous or puberulent on both surfaces, chartaceous to subcoriaceous; petioles 6-15 cm long, glabrous or pubescent. Stipules 3-8 mm long, 0.5-1 mm broad, lanceolate, acuminate, entire or sparsely denticulate to ciliate, glabrous, adnate to petiole to 3/4 length. Flowers 15-25 mm across, usually dark purple, sometimes light violet or white; peduncles 8-25 cm long, equalling or exceeding leaves, glabrous or pubescent. Sepals 3-6.5 mm long, 1-2 mm broad, ovate-lanceolate, acute to acuminate, entire, glabrous; appendages 1-1.5 mm long, rounded to squarish. Petals obovate to oblanceolate, the laterals bearded or rarely beardless, the basal emarginate or truncate at apex; spurs 3-5.5 mm long, 1.4-2.5 times as long as wide, cylindrical, rounded. Styles 2-2.5 mm long, geniculate at base, clavate distally, with prominent marginal lobes at apex, anterior stigmatic beak. Capsules 9-14 mm long, oblong or ellipsoid, glabrous. Seeds ovoid, 1.8 mm long. Chromosome number: $n=24$.

Distribution: Kuriles, Japan, Korea, Mandshuria, China.

Specimens examined:

Hsinchu: Kwanwu, Wang 4123, 4127.

Taichung: Chika, Huang 7089, Wang 4356; Chika-369 Hostel, Wang 4357, 4358, 4355; Chungyangchienshi-Nanhushi, Wang 3581; Wuling-Kuannshan, Kuoh 6992; Wuling-Hsinta Campus, Wang 3998; Taoshan-Wuling Farm, Wang 4108; Pingkuoshan, Tang s. n. May 9, 1986; Yoboran, Kano s. n. Jul. 19, 1931; Malikoan, Sasaki s. n. Oct. 10, 1930.

Nantou: Chihyuanshanchuang, Wang 2615, 3075, 3127, 4130, 4131, Tang 1292, S. H. Lin 23; Yunhai-Tunyuan, Fukuyama 4402, 4404, 4414; Chilaitzunanfeng, Sasaki s. n. Aug. 24, 1929; Kunyang-Yuanfeng, Wang 3418, 5096; Hsinjen-kang, Wang 3876, 5098; Yuanfeng, Wang 5097; Dueikuan-Kwankao, Yang s. n. Oct. 22, 1986; Kwankao, Wang 4287, 4296.

Chiayi: Alishan, Sasaki s. n. Oct. 1928, Mori 3503 (TAIF); Tozan, Ishizaki s. n. Jun. 3, 1924 (Type of *Viola oblongo-sagittata* form. *ishizakii*, TAI!); Mt. Niitaka, Kawakami & Mori s. n. Oct. 15, 1905 (TAIF).

Kaohsiung: Tienchih, Yang s. n. Apr. 3, 1988.

Ilan: Nanhutashan, Sasaki s. n. Oct. 1928; Pass Pianan, Pingyenshan, S. Suzuki s. n. Oct. 24, 1928; 710 logging tract, Yang s. n. Mar. 4, 1987.

Hualien: Chingshuishan, Liao s. n. Apr. 5, 1978 (NTUF); Tayuling-Pilu, Lin s. n. Jun. 21, 1983 (TAIF); Tayuling-Tzuen, S. F. Huang 175, Tang 92; Tayuling, Kuoh, Chuma & Chang 8554; Tayuling-Konankuan, Wang 4304, 4305, 4306, Hsu & Kuoh 7121; Hohuanshan, Ou & Kao 9141, Tang s. n. Oct. 18, 1985, Ying 634 (NTUF), 637 (NTUF).

11. *Viola nagasawai* Makino & Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 22: 30, 1906.

11a. *Viola nagasawai* var. *nagasawai*.

臺北堇菜 Fig. 13

Viola nagasawai Makino & Hayata in Journ. Coll. Sci. Imp. Univ. Tokyo 22: 30, 1906; Hayata, Icon. Pl. Form. 1: 60, 1911; W. Becker in Beih. Bot. Centralbl. 40: 116, 1923; Lin in Taiwania 1: 271, 1950; Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 30; Hsieh in Li *et al.* Fl. Taiwan 3: 776, 1977 (*pro parte*). (Syntype, Hayata s. n. 1900, TI!, U. Faurie s. n. 1903, TI!, Nagasawa 320, TI!)

Viola acutilabella Hayata, Icon. Pl. Form. 10: 1, 1921. (Syntype, Hayata & Sasaki s. n. May, 1917, TI!)

Viola nagasawai Makino & Hayata var. *acutilabella* (Hayata) Nakai in Bot. Mag. Tokyo 36: 87, 1922; Lin in Taiwania 1: 273, 1950.

Perennial herb; rhizome erect to ascending, rather thin, bearing rosette of leaves and flowers at apex, usually with stolons rooting at ends and producing dense rosettes of leaves and flowers. Leaves 1-3 cm long, 1-2.5 cm broad, ovate or elliptic, broadly cordate at base, rounded or obtuse at apex, crenate on margin, narrowly long decurrent on petiole, hirsute above, nearly glabrous beneath, herbaceous; petiole 1-7 cm long. Stipules 5-14 mm long, 1-2 mm broad, linear-lanceolate to lanceolate, acuminate at apex, sparsely fimbriate-laciniate on margin, partly adnate to the petioles. Flowers 15-20 mm across, pale purple to almost white with dark violet veins on the basal petal; peduncles 4-17 cm long, slender, twice to 4 times as long as petioles. Sepals 5-8 mm long, 1-1.5 mm broad, linear-lanceolate to linear, acute at apex, sparsely fimbriate-ciliate on margin; appendage

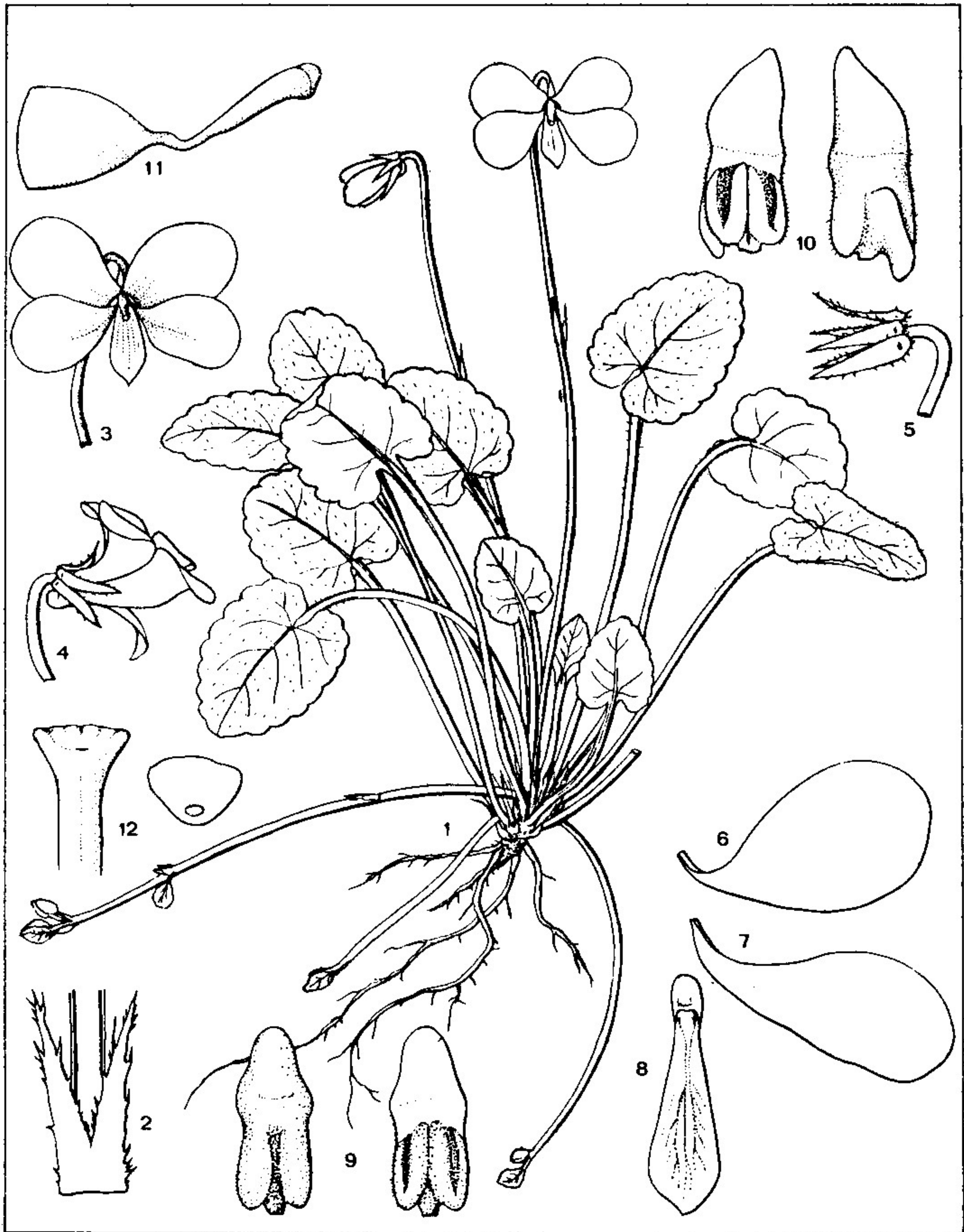


Fig. 13. 臺北堇菜 *V. nagasawai* Makino & Hayata

1. Habit; 2. Stipule; 3, 4. Flowers; 5. Calyx; 6. Upper petal; 7. Lateral petal; 8. Basal petal; 9, 10. Stamens; 11. Pistil; 12. Styles.

up to 0.5 mm long, rounded, fimbrio-ciliate. Petals obovate, the basal shortest, acute at apex, laterals beardless; spurs 1–1.5 mm long, obtuse. Styles ca. 2 mm long, geniculate at base, clavate distally, with two lateral lobes at apex, anterior stigmatic beak. Capsules 5–6 mm long, ellipsoid, glabrous. Seeds ovoid, 1–1.2 mm long. Chromosome number: $n=24$.

Distribution: Endemic.

Specimens examined:

Taipei: Yangmingshan, Kudo, Suzuki & Mori s.n. Apr. 21, 1929, Kudo & Suzuki 3304, Tanaka & Shimada 11004, Chuang 2721; Chishingshan (Mt. Sitisei), Shimizu 634, Kuo 6822, 9840, S. Suzuki s.n. Sept. 3, 1926, s.n. Mar. 21, 1928, s.n. Dec. 1, 1929, Hsu 3199, 9278, Yang 1221, T. Y. Yang 628, Sasaki s.n. Apr. 1, 1911, s.n. Mar. 1912 (TAIF), s.n. Oct. 1927, Tang 434, Wang 3550, 3551, 3552, 3553, 3555, 3556, 3557, 3558, 3559, 3560, 4202, 4203, Yang s.n. Apr. 25, 1987; Shichiseitonzan, Hayata s.n. 1900 (Type of *Viola nagasawai*, TI!), Kawakami & Sasaki s.n. Dec. 1, 1907 (TAIF); Shimada s.n. Apr. 2, 1910 (TAIF); Yangmingshan-Chishingshan, Yang & Chiang 178, Hsu 3164; Fonlin Fall, Yang 1078; Tatunshan (Mt. Daiton), U. Faurie s.n. 1903 (Type of *Viola nagasawai*, TI!), Sho 34, 35, 36, Hsu 11477, S. Suzuki 10231, L. S. Chern 13, Y. F. Chen et al. 1073, Shimada s.n. Apr. 23, 1933, C. Tseng 3962, Kao 3614, 3727, Murata & T. Y. Yang 17849; Tatunshan-Peihsinchuang, Lin s.n. Mar. 21, 1986; Tsutzuhu (Tikusiko), Nagasawa 320 (Type of *Viola nagasawai*, TI!), S. Suzuki 4382, 7477, 7478, 7481, 7531, Simada 1171, Chuang 3894, 3895, Nakamura 250, Okamoto s.n. Mar. 1913 (TAIF), Shimada s.n. Feb. 24, 1914 (TAIF); Yangmingshan-Tsutzuhu, Kao s.n. Feb. 9, 1955; Sendanyama, T. Suzuki 7479; Mt. Syokwannon, Shimada 338; Menghuanhu, Wang 2877, 3429, 5071, Yang s.n. Oct. 18, 1986; Chungshing farm, Wang 4116, Hsieh et al. s.n. Apr. 30, 1987; Peichatienshan, Hsieh & Lin s.n. Sept. 5, 1986; Polushan, Chen s.n. Aug. 19, 1986; Ruggyahu Maherokku, T. Suzuki 16628, 16440; Sihoyanzan, T. Suzuki ST14630b; Kabozan, Fukuyama, ST19232; Talingka, Nakamura 4299; Mentienshan, Simada s.n. Oct. 31, 1914 (TAIF); Rimogan, Mori s.n. Jun. 7, 1905 (TAIF).

Taoyuan: Sotenzan, Mori s.n. May 25, 1908 (TAIF); Lalashan, Hsieh et al. s.n. May 9, 1986.

Ilan: Taipingshan, Yang s.n. Apr. 30, 1987, Sasaki s.n. Apr. 25, 1930, S. Suzuki 992, s.n. Jul. 26, 1929, s.n. Aug. 9, 1928; Shernmihu, Wang 5051; Mt. Egiri, Mori s.n. Apr. 11, 1908 (TAIF); Shuangshengchiao, Hayata s.n. May 11, 1916 (TAIF); Gentoan, T. Suzuki ST17767; Mt. Bonbon, Hayata & Sasaki s.n. May 1917 (Type of *Viola acutilabella*, TI!).

11b. *Viola nagasawai* var. *pricei* (W. Becker) J. C. Wang & T. C. Huang stat. nov.

普萊氏堇菜 Fig. 14

Viola pricei W. Becker in Bull. Inst. Fard. Bot. Univ. Belyrad 1: 252, 1928; in Kew Bull. Misc. Inform. 6: 252, 1928; Lin in Taiwan 1: 283, 1950 (as excluded species); Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 30.

Viola nagasawai (non Hayata) Hsieh in Li et al. Fl. Taiwan 3: 776, 1977 (*pro parte*).

Leaves triangular-ovate to lanceolate, acute at apex, hirsute on both surfaces.

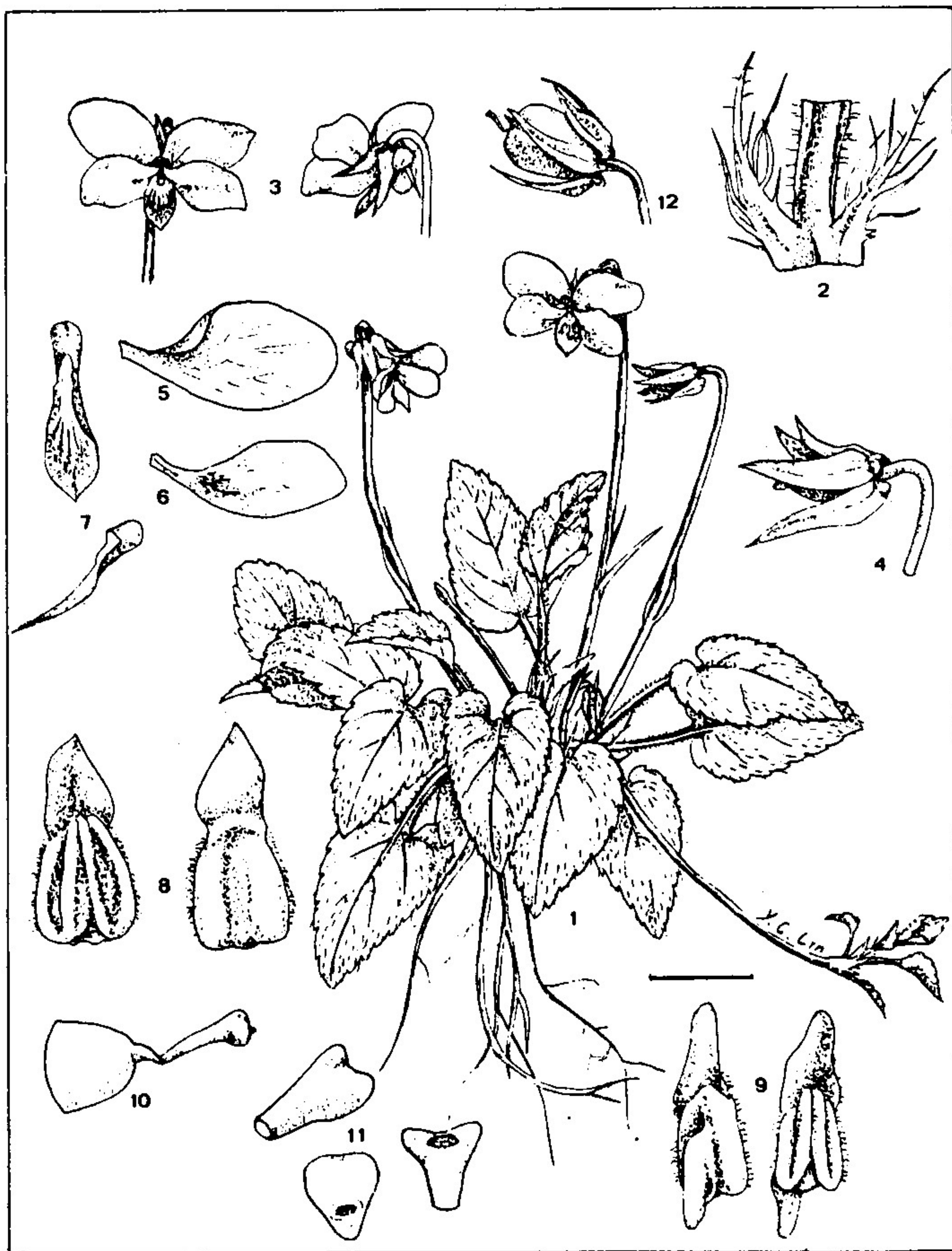


Fig. 14. 普萊氏堇菜 *V. nagawai* Makino & Hayata var. *pricei* (W. Becker) J.C. Wang & T.C. Huang.

1. Habit; 2. Stipule; 3. Flowers; 4. Calyx; 5. Upper petal; 6. Lateral petal; 7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Styles; 12. Capsule.

Sepals sparsely ciliate to almost entire on margin; lateral petals bearded. Chromosome number: $n=24$.

Distribution: Endemic.

Specimens examined:

Taipei: Urai, *Simada* s.n. Apr. 1, 1918 (TAIF), *Y.F. Chen* 4513, *Yang* 350, *S.H. Lin* 488, *Tang* s.n. Apr. 11, 1986, *S. Suzuki* 10131, s.n. Mar. 28, 1932; Wulai-Wawaku, *T.Y. Chiang* 193; Jiajouling, *Kawakami & Mori* s.n. Mar. 11, 1906; Rimogan, *Kawakami & Mori* 5063 (TAIF).

Taoyuan: Lalashan, *Huang* 7669; Chienkopai, *Sasaki* s.n. Mar. 14, 1906, *Mori* s.n. Mar. 14, 1906; Ssuling-Paling, *Wang* 3529, 3530, 3531, 3533, 3537, 3538, 3539, 3540, 3543.

Hsinchu: Kwanwu, *Wang* 4903.

Taichung: Wurui, Tungshih, *Sasaki* s.n. Jul. 25, 1932; *S. Suzuki* s.n. Feb. 11, 1928; Chingshan, *S.F. Huang* 622, *Wang* 5060; Gukuan-Chingshan, *Wang* 2974, 3485, 3486, 3490, 3491, 3493, *J. Murata* 17585, *Huang et al.* 9623, *T.Y. Yang* 1391.

Ilan: Ssuyuan-Nanshan, *Wang* 3545.

Hualien: Hoping logging tract, *Tang* s.n. May 8, 1986.

Note: The taxon was treated as conspecies of *V. nagasawai* in Flora of Taiwan (Hsieh, 1977). They can be distinguished by the leaf shape, beardness of lateral petals and also the ecology.

The foliar morphology of this subspecies is rather variable. The leaf blades are typically triangular-ovate, but lanceolate or deltoid are also frequent; leaves base are varied from cordate, shallowly cordate to truncate.

12. *Viola obtusa* (Makino) Makino var. *tsuifengensis* Hashimoto in Ann. Tsukuba Bot. Gard. 1: 3, 1987. 翠峰堇菜

Perennial herb; rhizome horizontal to erect, more or less stout, bearing stems and leaves at apex. Stem up to 15 cm, ascending to erect. Basal leaves 1.5–3 cm long, 1.5–2.5 cm broad, cordate-ovate, acute at the apex, cauline leaves 1–2.5 cm long, 0.9–2.8 cm broad, triangular-cordate, shallowly cordate to nearly truncate at base, acute to acuminate at apex, depressed crenate on margin, glabrous or sparsely pubescent on both surfaces, herbaceous to chartaceous; petioles 0.5–2 cm long, shorter or equal to the blades. Stipules 8–10 mm long, lanceolate to linear-lanceolate, acuminate at apex, sparsely fimbriate-laciniate on margin, glabrous, free. Flowers 1–1.5 cm across, light purple; peduncles 3–6 cm long, slender, exceeding leaves. Sepals 5–7 mm long, ca. 1 mm broad, lanceolate, acuminate at apex, entire, glabrous; appendages 1–1.5 mm long, sparsely dentate or squarish, glabrous. Petals oblong to oblanceolate, 2–3 mm broad, basal longest, somewhat rounded at apex, the laterals beardless; spurs ca. 2 mm long, slightly exceeding calycine appendages, cylindrical, obtuse. Styles 3 mm long, geniculate at base, apex rostrate, stigmatic opening terminal. Capsules erect, 5–7 mm long, ellipsoid, glabrous. Seeds ovoid, ca. 1.2 mm long.

Distribution: Endemic.

Specimens examined:

Hsinchu: Kwanwu, *Wang* 4126.

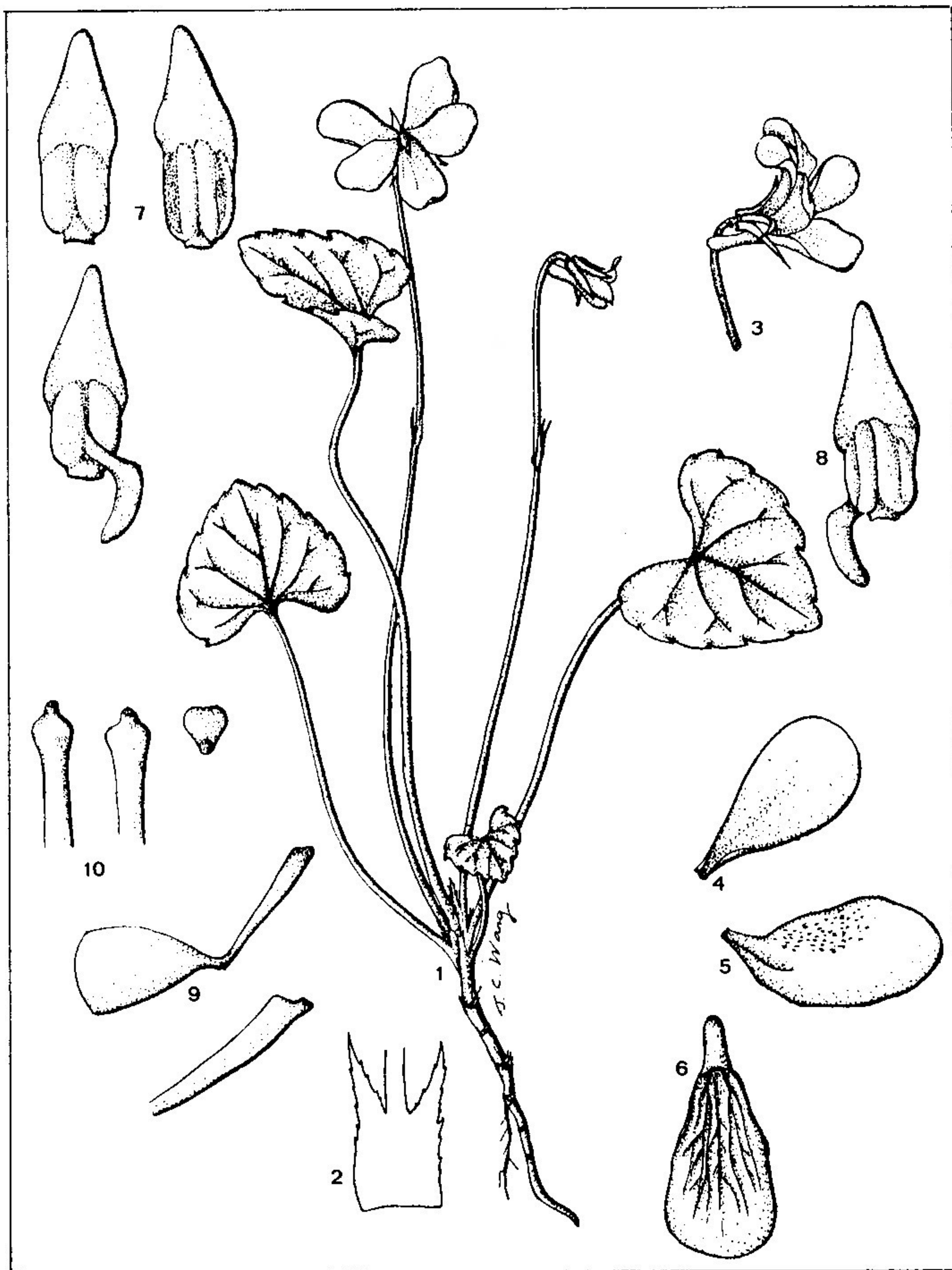


Fig. 15. 尖山堇菜 *V. senzanensis* Hayata

1. Habit; 2. Stipule; 3. Flower; 4. Upper petal; 5. Lateral petal;
6. Basal petal; 7, 8. Stamens; 9. Pistil; 10. Styles.

Taichung: Wuling farm, *K. C. Yang* s. n. Apr. 24, 1988.

Note: The taxon is still insufficiently known to us, since few specimens with flower were examined. When comparing with the Hashimoto's description, our material fits very well except the smaller flower which is probably a semicleistogamous flower produced in the late flowering season.

13. *Viola senzanensis* Hayata, Icon. Pl. Form. 6: 3, 1916; Nakai in Bot. Mag. Tokyo 36: 92, 1922; Lin in Taiwania 1: 276, 1950; Hsieh in Li *et al.*, Fl. Taiwan 3: 782, 1977. (Type, *T. Ito* s. n. Jun. 11, 1915, Taihasenzan, TI, photo!) 尖山堇菜 Fig. 15

Perennial herb; rhizome long creeping to ascending, slender, bearing leaves and flowers at apex, acaulescent. Leaves 1.2–2.8 cm long, 2–3.8 cm broad, triangular-cordate, reniform cordate at base, with the basal lobes somewhat converging, acute to obtuse at apex, shallowly serrate on margin, wingless, glabrous or pubescent on both surfaces, herbaceous to chartaceous; petioles 2–11 cm long, glabrous. Stipules 5–10 mm long, 1–2 mm broad, lanceolate, acute, slightly laciniate-serrate or entire, glabrous, membranous, adnate to petiole to 2/3 length. Flowers 10–15 mm across, almost white, with dark violet veins; peduncles 4–10 cm long, exceeding leaves, slender, glabrous or sparsely pubescent. Sepals 3.5–6 mm long, 0.8–1.5 mm broad, ovate-lanceolate to lanceolate, acute, entire, glabrous; appendages 1 mm long, rounded. Petals obovate to oblong, laterals beardless, the basal equalling the others, rounded at apex; spurs slender, 2–3 mm long, cylindrical, rounded. Styles 2–2.7 mm long, slightly geniculate at base, clavate distally, with apex slightly lobed on both sides, anterior stigmatic beak. Capsules 6–9 mm long, oblong or ellipsoid, glabrous. Seeds ovoid, ca. 2 mm long. Chromosome number: $n=12$ with 1–4 B-chromosomes.

Distribution: Endemic.

Specimens Examined:

Hsinchu: Hsinta Campus-Tapachienshan, *Wang* 4536.

Miaoli: Hsiaohsuehshan, *Wang* 4944, *T. Y. Yang* 423.

Taichung: Taihasenzan, *Ito* s. n. Jun. 1914 (TAIF); Tapachienshan-Karantkushan, *Wang* 4602, *Sasaki* s. n. Jul. 20, 1932; Hsuehshan, *Wang* 4354, 4634; Chihyoushan-Taoshan, *Wang* 3885; Taoshan-Wuling Farm, *Wang* 4107; Nanhunanfeng, *Wang* 3577.

Nantou: Hohuanshan, *Lin* s. n. May 28, 1985, *Wang* 4307, 4309; Kunyang-Yuanfeng, *Wang* 3416, 3419; Patungkuanshan, *Yang* s. n. Oct. 21, 1986; Mabolasushan, *Wang* 4289; Hsioukuluanshan, *Wang* 4290; Yushan, *Wang* 4294; Kunyang, *Wang* 5112.

Chiayi: Yushan, *Yang* s. n. Oct. 31, 1986, *Chuang et al.* 3992, *Ying* 1405 (NTUF).

Ilan: Nanhutashan, *Masamune, Fukuyama & Nakamura* 3163, *Sasaki* s. n. Oct. 1928 (TAIF); Yunlingshanchuang-Shermashenshan, *Wang* 3563.

Hualien: Nanhutungfeng, *Wang* 3566, 3568.

14. *Viola shinchikuensis* Yamamoto in Journ. Soc. Trop. Agr. 5: 352, 1933; Lin in Taiwania 1: 281, 1950. (Syntype, *Simada* 2390c, TAI!, *Simada* 2391c, TAI!)

新竹堇菜 Fig. 16

Viola nagamiana Hashimoto in Ann. Tsukuba Bot. Gard. 6: 1, fig. 1, 1987. syn. nov.

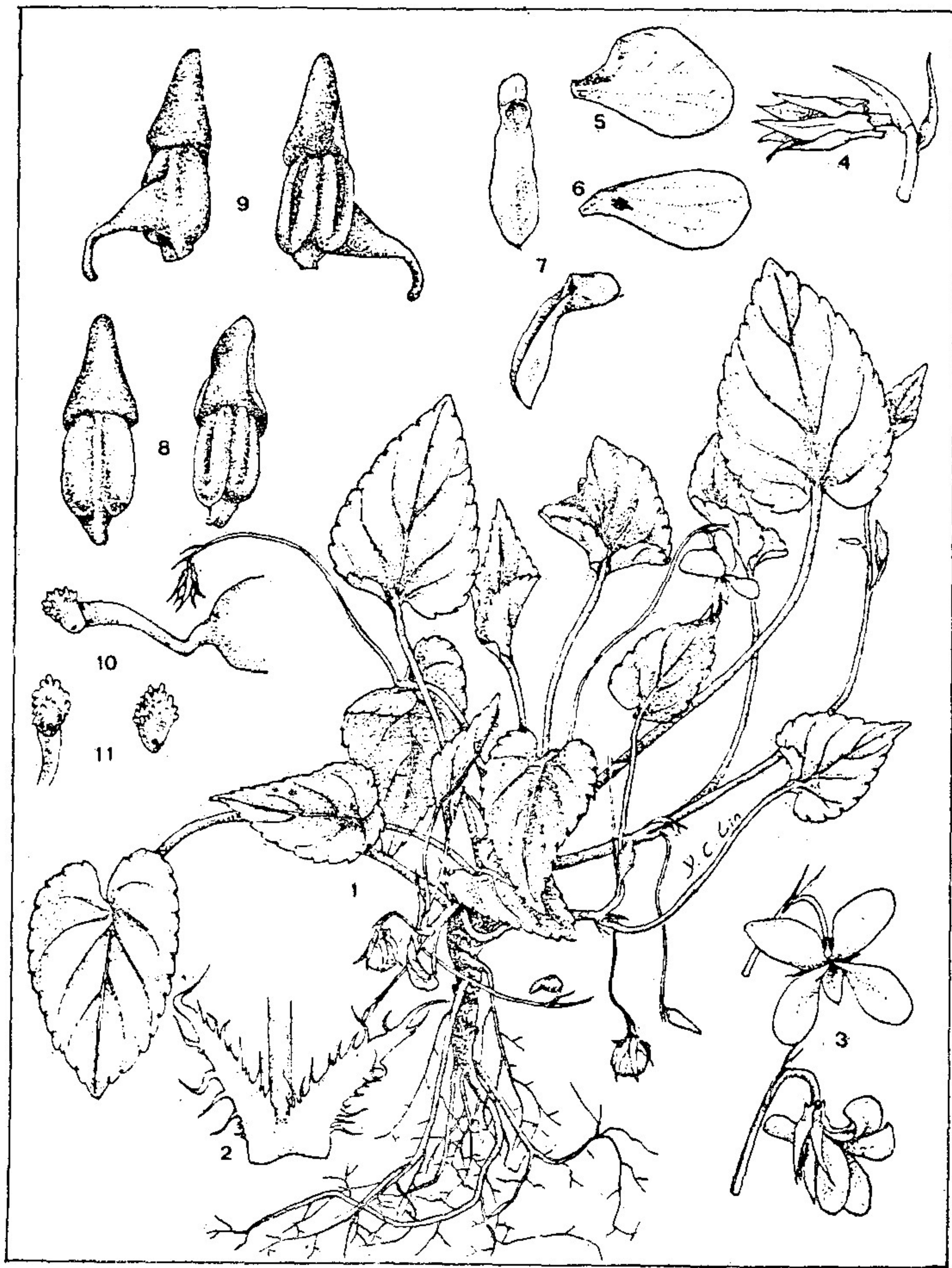


Fig. 16. 新竹堇菜 *V. shinchikuensis* Yamamoto

1. Habit; 2. Stipule; 3. Flowers; 4. Calyx; 5. Upper petal; 6. Lateral petal; 7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Styles.

Perennial herb; rhizome horizontal to ascending, often elongate, bearing stems and leaves at apex. Stem up to 25 cm, ascending, rooting at ends and producing dense rosettes of leaves and flowers. Leaves 2–4 cm long, 1.5–4 cm broad, cordate, cordate to deeply cordate at base, short acuminate or acute at apex, depressed crenate-serrate on margin, glabrous or sparsely pubescent on the upper surface, pale beneath, chartaceous; petioles 3–10 cm long, glabrous. Stipules ca. 10 mm long, 1–2 mm broad, narrowly lanceolate, acuminate at apex, fimbriate-laciniate on margin, glabrous, fuscous, free. Flowers 10–16 mm across, pale violet to almost white, with dark violet veins on the basal petal, yellowish green at base of every petal; peduncles 3–10 cm long, slender, equalling leaves. Sepals 3–6 mm long, 1–1.2 mm broad, narrowly lanceolate, acute at apex, entire, glabrous; appendages 1–2 mm long, dentate, glabrous. Petals obovate, basal shorter or equalling the others, rounded or obtuse at apex, laterals bearded; spurs 2–2.5 mm long, exceeding calycine appendages, cylindrical, obtuse. Styles 1.6–2 mm long, gently geniculate at base, somewhat thickened distally, minutely papillose at apex, anterior stigmatic opening. Capsules 4–6 mm long, globose, glabrous, peduncle prostrate when mature. Seeds ovoid, ca. 1.8 mm long, with conspicuous elaiosome. Chromosome number: $n=10$.

Distribution: Endemic.

Specimens examined:

Taoyuan: Ssuling-Paling, Wang 3528, 3544.

Hsinchu: Mt. Yura, Y. Simada 2390c (Type of *V. shinchikuensis*, TAI!); Tikutô, Mentoyû, Y. Simada 2391b (TAIF), 2391c (Type of *V. shinchikuensis*, TAI!); Kwanwu, Wang 4905.

Taichung: Wuling Farm, Wang 3894a; Wuling Farm-Hsinta Campus, Wang 3996.

Nantou: Pilushi, Wang s.n. Apr. 13, 1985, T. Y. Yang s.n. Nov. 8, 1986; Tsuifeng, Hayata s.n. Apr. 20, 1916 (TAIF), Wang 5099; Tsuifeng-Meifeng, Wang 5101, 5102, T. Y. Yang 87; Hsinjenkang, Wang 3880, 5100; Tungpu-Dueikuan, Yang s.n. Mar. 29, 1986, Wang 4275, 4281, 4282, 4284; Dueikuan-Kwankao, Yang s.n. Oct. 22, 1986.

Chiayi: Tozan, Ishizaki s.n. Jul. 3, 1924 (*pro parte*).

Pingtung: Ali, Wang 3449, H. N. Yang 2050; Chiaokuolachih, Wang 3446; Wutai, I. S. Chen 1544, 1577 (*pro parte*), 1602 (*pro parte*).

Note: Two type specimens cited by Yamamoto (1933) are flowerless. The floral morphology is not clear until many specimens were collected by the authors. Its diagnostic characters are as follows: stylar apex papillose, lateral petals bearded, basal petal shorter than the upper and lateral ones, capsule globose, peduncle prostrate when mature, seeds with conspicuous elaiosome. The description of *V. nagamiana* (Hashimoto, 1987) fits the characters above very well. Many specimens collected from type locality of *V. nagamiana* are also examined, and no any difference with *V. shinchikuensis* is found, they are conspecies, undoubtedly.

15. *Viola tenuis* Benth. in Hook. Lond. Journ. Bot. 1: 482, 1842.

心葉茶匙黃 (新擬中名) Fig. 17

Viola diffusa Ging. ssp. *tenuis* (Benth.) W. Becker in Philip. Journ. Sci. 19: 714,

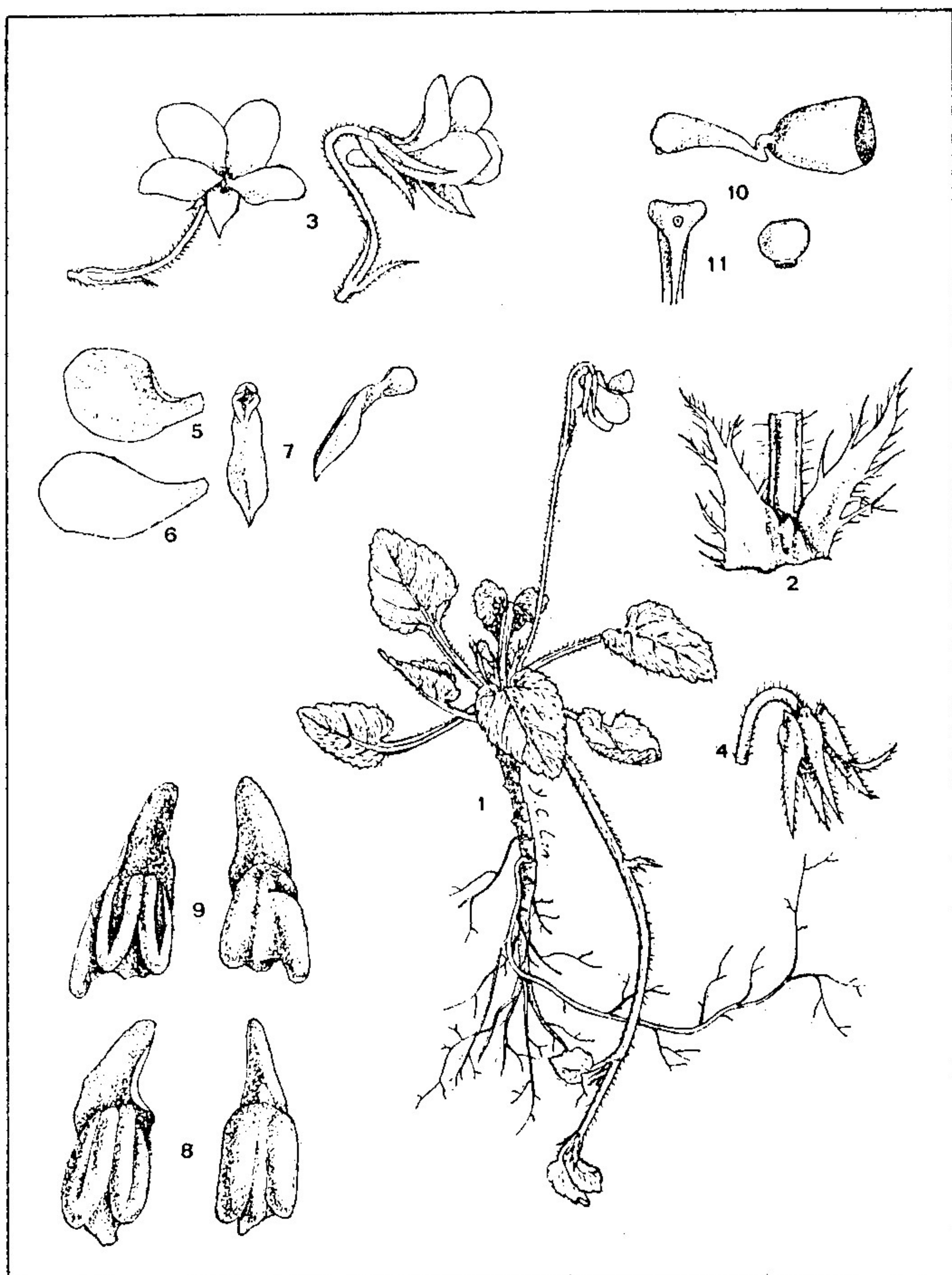


Fig. 17. 心葉茶匙黃 *V. tenuis* Benth.

1. Habit; 2. Stipule; 3. Flowers; 4. Calyx; 5. Upper petal; 6. Lateral petal; 7. Basal petal; 8, 9. Stamens; 10. Pistil; 11. Styles.

1921 (*pro parte*); in Beih. Bot. Centralbl. 40: 11, 1923 (*pro parte*); Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 30.

Perennial herb; rhizome erect to ascending, rather thin, fibrillose, bearing rosette of leaves and flowers and procumbent rooting stem at apex. Stem up to 12 cm, rooting at ends and producing dense rosettes of leaves and flowers. Leaves 0.5–3 cm long, 1–2 cm broad, smaller on stolons, ovate or elliptic, cordate at base, subacute to rounded or obtuse at apex, crenate to serrate-crenate on margin, long decurrent on petiole, hirsute, herbaceous; petioles 1–7 cm long. Stipules 5–9 mm long, 1–1.5 mm broad, lanceolate to ovate-lanceolate, acuminate at apex, dentate to ciliate on margin, free. Flowers 7–13 mm across, pale violet to almost white; peduncles 1.5–7 cm long, exceeding leaves. Sepals 3–6 mm long, 1–1.5 mm broad, lanceolate, acute at apex, sparsely pubescent, fimbrio-ciliate on margin, green; appendages up to 0.5 mm long, rounded, fimbrio-ciliate. Petals obovate, the basal shortest, acute at apex, the laterals beardless or rarely sparsely bearded; spurs 0.5–1 mm long, obtuse. Styles ca. 1.2 mm long, geniculate at base, clavate distally, with two lateral lobes at apex, anterior stigmatic beak. Capsules 4–6 mm long, ellipsoid, glabrous. Seeds ovoid, ca. 0.8 mm long. Chromosome number: $n=37$.

Distribution: S. China, the Philippines, New Guinea.

Specimens examined:

Nantou: Meifeng, Wang 3884, 5108, 5109, 5110.

Pingtung: Amawansya, Sasaki s.n. Feb. 29, 1920 (TAIF).

Taitung: Payuchih (Kwei-hu), Wang 3434, 3433, 3445; Taito, Kawakami s.n. Apr. 1905 (TAIF).

Note: The species can be distinguished from *V. diffusa* by the cordate leaf base, glabrous lateral petals and larger pollen grains ($24-28 \times 25-30 \mu$ against $16-20 \times 17-20 \mu$ of *V. diffusa*) as well as the chromosome number.

Doubtful species

Viola longistipulata Hayata, Icon. Pl. Form. 3: 29, fig. 14, 1913; Lin in Taiwania 1: 281, 1950 (as doubtful species). (Type, Formosa, loco non indicato, TI!)

V. japonica (non Langsd.) Hashimoto in Bull. Jap. Assoc. Bot. Gard. 1959, 35.

Note: The species is based on a single specimen "Formosa, loco non indicato" cited by Hayata (1913). Judging from the characteristics of stipule shape, acaulescent habit and short rhizomes by examining the type specimen, this species undoubtedly belongs to "*Adnatae* group". But no other Taiwanese species known to us in this group is similar to it, we treat it as doubtful species temporarily.

ACKNOWLEDGEMENT

We thank the administrators of the Herbaria cited above for loan of specimens. We also thank Dr. Tamotsu Hashimoto, Tsukuba Botanical Garden, for sending us his valuable publications, Dr. Jin Murata of Tokyo University and Mr. Chung-Fu Shen of New York Botanical Garden for providing copies of useful literatures, and Miss Yun-Chen Lin, Miss Ching Chen for their fine illustrations.

LITERATURE CITED

- BECKER, W., 1916. *Violae Asiaticae et Australensis*. I. Beih. Bot. Centralbl. Abt. 2, 34: 208-266. (in Germany)
- BECKER, W., 1925. *Viola*. In Engler & Prantl, Die Natürlichen Pflanzenfamilien, 2 Aufl. 21: 363-376. (in Germany).
- BECKER, W., 1928. On the type specimen of *Viola confusa*. Kew. Bull., 383-384.
- HASHIMOTO, T., 1959. A short survey on genus *Viola* from Formosa. Bull. Jap. Assoc. Bot. Gard., 29-35. (in Japanese)
- HASHIMOTO, T., 1967a. Die verbreitung einfach-griffeliger veilchen. Inf. Ann. Hort. Bot. Fac. Sci. Univ. Tokyoensis, 41-43. (in Germany)
- HASHIMOTO, T., 1967b. The Violets of Japan. 227pp. Seibundo-Shinkosha (Tokyo). (in Japanese)
- HASHIMOTO, T., 1987. Trigonocarpace violets of Taiwan. Ann. Tsukuba Bot. Gard. 6: 1-7.
- HEYWOOD, V. H., 1978. Flowering Plants of the World. pp. 100-101. Mayflower Books, Inc., New York.
- HIRAYAMA, R., T. KONISHI and T. HASHIMOTO, 1987. A study on the relationship between infraspecific variation and soil environment factors in *Viola verecunda* A. Gray. Ann. Tsukuba Bot. Gard. 6: 41-51. (in Japanese)
- HSIEH, C. F., 1977. Violaceae, In Li, H. L. et al. (eds.), Flora of Taiwan. 3: 769-784. Epoch Inc. Taipei, Taiwan.
- JACOB, M. and D. M. MOORE, 1971. Violaceae, In C. G. G. L. van Steenis (ed.), Flora Malesiana 7(1): 179-212.
- LIN, H. T., 1950. Notes on the genus *Viola* in Taiwan. Taiwania 1: 269-283.
- MAEKAWA, F. and T. Hashimoto, 1968. Nomenclatural treatments for the violets of Japan. Journ. Jap. Bot. 43: 161-163.
- MASAMUNE, G., 1936. Short Flora of Formosa. pp. 142-143. Taihoku (Taipei).
- MASAMUNE, G., 1954. A List of Vascular Plants of Taiwan. pp. 57-58. Kanazawa Univ. Japan.
- NAKAI, T., 1922. Notes on Japanese violets. I, II, III. Bot. Mag. Tokyo 36: 52-61, 84-93, 118-121. (in Japanese)
- SASAKI, S., 1928. List of Plants of Formosa. pp. 296-298. Nat. Hist. Soc. Form., Taihoku (Taipei).
- WANG, J. C., 1988. A Taxonomic Study of *Viola* (Violaceae) of Taiwan. Ph. D. Dissertation of National Taiwan University, Taipei, Taiwan.
- VALENTINE, D. H., 1962. Variation and evolution in the genus *Viola*. Preslia 34: 190-206.
- YAMAMOTO, Y., 1933. Observations ad floram Formosanum. VIII. Journ. Soc. Trop. Agr. 5: 352.

臺灣植物誌之觀察 (9)

堇菜屬 (堇菜科)

王震哲 黃增泉

摘 要

本文處理臺灣產堇菜屬 (*Viola*) 植物 18 分類羣及一疑問種，其中包括四個新組合。依據形態學上，尤其是花柱形態之特徵可將這些種類歸屬於八羣。